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THE FOUNDRY

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COMPARATIVE FOUNDRY COST RECORDS

System used by a large gray iron foundry for obtaining labor and production costs---Curve sheet showing rates of wages

By G. E. Andres

COMPARATIVE records of labor cost and production are of inestimable value to the foundry superintendent. These factors are subject to wide fluctuation and unless some system is adopted, whereby the slightest increase or decrease in labor cost and tonnage is recorded, the shop executive will be unable to correct conditions until heavy losses have been sustained. The system of comparative records, described herewith, is being successfully employed by one of the largest foundries in the country and it can be adopted by all casting plants without modification, regardless of size and nature of work. While this system has been especially devised for the shop superintendent to enable him to obtain a better grasp on conditions in his plant from day to day, the information thus tabulated should prove invaluable to the management in estimating quotations for new work. The cards, record sheets and charts, shown herewith, present only monthly data, being computed from daily and weekly reports. To obtain the correct information, however, the various foundry departments must first be properly systematized.

Labor Problem.

The question of labor is one of the most important problems with which the foundry superintendent is compelled to cope and the large number of unskilled men required in foundry work makes it exceedingly difficult to properly proportion the number of unskilled and skilled employes. In Fig. 2 is shown a card that contains monthly and annual averages of the number of men employed. The operating force is divided into nine classifications, including molders, coremakers, chippers and grinders, laborers, other foundry laborers, such as crane men, hookers-on, sand riddle men and elevator operators, carpenters, the repair gang, machinists, tinners and blacksmiths, patternmakers in both the wood and metal pattern departments and the office force. The average monthly output of castings in pounds is also entered on this card. The data is taken from the daily labor report, Fig. 1, which is itemized to indicate the number of hours the men in each department were employed. Each foreman is furnished a shop order, showing miscellaneous labor. For instance, a department has a three-hour job for a laborer and when this work has been completed, the foreman shifts this workman to another department, where he is given a job which keeps him busy an additional three hours. During the last three hours of the day the same laborer will probably be engaged in hauling sand for another foreman, thus completing his day's work. This labor is charged against three different departments and each department is charged with three hours' labor. It is evident, therefore, that these labor items cannot be accurately entered by reporting the number of men actually employed and it has been found that when reporting the total number of men instead of the number of hours employed on each job, the foreman becomes careless when shifting the laborers from one job to another. However, when the foreman knows that every hour of the laborer's time is being charged against some department, he will exercise great care in accounting for every hour of the employe's time. On this report, shown in Fig. 1, is also itemized the labor required for unloading, hauling and handling materials, making repairs, etc.

DAILY LABOR REPORT

DATE 5/15/10

SHOP ORDER NO.		CLASS	DAY	NIGHT	TOTAL	
10	MOLDERS		80	10	90	MEN
11	COREMAKERS		22	3	25	"
12	CLEANERS		26	8	34	"
60	LABORERS	DEPT. A	100	30	130	HOURS
61	"	" B	80	20	100	"
62	"	" C	30	10	40	"
63	"	CORE	40	10	50	"
64	"	CLEANING	20		20	
30		CUPOLA	6		6	MEN
31		CRANES	8		8	"
32		PATTERNS	22		22	HOURS
33		UNLOADING	32		32	"
34		TEAMSTER	2		2	MEN
35		WATCHMEN	2	2	4	"
36		SCRAPPING	16		16	HOURS
37		SHIPPING	12		12	"
38		REPAIRS	36	10	46	"
39		CARPENTERS	2		2	MEN
40		PATTERN M'KS	8		8	"
41		FIREMEN	2	1	3	"
42		OVENS	1		1	"
	MISCELLANEOUS					
86	CLEANING	YARD	12		12	HOURS
85	SCREENING	COKE	6		6	"
86	HAULING	CHARCOAL	3		3	"
85	HANDLING	FLASKS	15		15	"
86	HAULING	SAND	9		9	"
87	PREPAIRENG	LADLES	5		5	"
88	TUMBLER	ROOM	22		22	"
		TOTAL MISC. LABOR			540	HOURS
					90	MEN
		OTHER LABOR			183	"
		GRAND TOTAL			243	"

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FIG. 1—DAILY LABOR REPORT

Comparison of Number of Employes With Output

After taking the averages from the daily labor report, the monthly record is posted to the card, shown in Fig. 2, which is arranged to afford easy comparison from month to month of the output of castings and the number of

MONTHLY AVERAGE OF MEN EMPLOYED

MONTH	YEAR	OUTPUT POUNDS	MOLDERS	CORE-MAKERS	CHIPPERS AND GRINDERS	LABORERS	OTHER FOUNDRY LABOR	CARPENTERS REPAIR MACHINE	PATTERN-MAKERS	OFFICE	TOTAL
Jan.	1900	1,740,200	123	35	47	99	30	28	12	13	382
Feb.	1900	2,003,000	123	41	48	105	33	25	11	13	399
Mar.	1900	1,822,200	128	45	51	103	32	25	11	13	408
Apr.	1900	1,932,500	138	46	54	107	36	27	12	12	432
May	1900	2,126,000	145	47	57	106	37	27	12	12	443
June	1900	1,986,950	156	43	58	113	33	27	11	12	453
July	1900	2,121,290	117	32	47	94	30	25	12	11	368
Aug.	1900	956,540	84	17	31	63	24	22	10	8	259
Sept.	1900	727,320	58	12	20	58	15	18	9	8	198
Oct.	1900	517,580	40	9	12	32	11	15	9	7	135
Nov.	1900	316,270	27	6	10	19	7	12	7	6	94
Dec.	1900	268,890	24	5	9	17	6	10	6	6	83
YEARLY AVERAGE		1,376,578	97	28	37	16	25	22	10	10	305

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FIG. 2—MONTHLY AVERAGE OF THE NUMBER OF MEN EMPLOYED

men employed. In the last column of this card is entered the total number of men employed for each month and in the spaces at the bottom the yearly average of output and the average number of men employed in each department, as well as the average total operating force, are entered. The output of the foundry, in pounds, is included to arrive at the proportion of the various classes of labor per pound of output. It will be noted in Fig. 2 that during the month of February the output totaled 2,003,000 and the average number of laborers employed was 105. In other words, one laborer was employed for each 19,076 pounds of output during that month. In March, the production dropped to 1,822,200 pounds and an average of 103 laborers was employed during that period. The output per laborer this month declined to 17,691 pounds. This indicates that the force of laborers was not sufficiently reduced in number in proportion to the decline in the output and to maintain the proper ratio the total number of laborers employed should have been reduced from 105 in February to 94 in March, instead of 103. This is a difference of nine laborers, whose wages average about $40 per month, and indicates a total loss of $360 during this period in the labor cost alone. To obviate this, it is essential for the foundry superintendent to closely watch his daily reports which will permit him to maintain the proper ratio between the number of employes and the production.

This card will also prove invaluable during periods of depression when the tonnage output is rapidly declining and the operating force must be reduced in proportion to the output. It will be noted, in Fig. 2, that the output in August was only 956,540 pounds, as compared with 2,121,290 pounds in July, while the miscellaneous labor force in July was only 94. It was reduced to 63 in August and a further reduction in the number of laborers was made to maintain the proper ratio until the force totaled only 17 in December, when the output dropped to 268,890 pounds. The operating forces in other departments must similarly be reduced and even the office force declined from 13 in February to six in December. Pattern repairs must be deferred until business conditions improve, and while the entire pattern shop force could probably be thus employed during the period of depression, it is essential that the force be reduced until such time when the output is again increased. It is obvious that it would not be consistent to decrease the number of employes in all of the departments in proportion to the output, nevertheless this card is a good record of actual shop conditions and affords a means for gaging the proper reduction in the operating force.

AVERAGE RATE OF WAGES PAID PER HOUR - LABORERS

MONTH	YEAR	¢ 16	¢ 17	¢ 18	¢ 19	¢ 20	¢ 21	¢ 22	¢ 23	¢ 24	¢ 25	¢ 26	¢ 27	¢ 28	¢ 29	¢ 30	¢ 31	¢ 32	¢ 33	¢ 34	¢ 35	¢ 36	TOTAL MEN	AMT.	AVGE PER HOUR CENTS
Jan.	1900	5	48	22	8	3	3	2			2	2	1			2		1					99	$18.32	18.5
Feb.	1900	6	52	23	8	3	3	2			2	2	1			2		1					105	19.34	18.4
Mar.	1900	6	50	23	8	3	3	2			2	2	1			2		1					103	19.00	18.4
Apr.	1900	7	53	23	8	3	3	2			2	2	1			2		1					107	19.67	18.3
May	1900	7	52	23	8	3	3	2			2	2	1			2		1					106	19.50	18.3
June	1900	7	55	24	8	4	4	3			2	2	1			2		1					113	20.82	18.4
July	1900	6	45	20	6	3	3	3			2	2	1			2		1					94	17.45	18.5
Aug.	1900	5	22	19	5	2	2	2			1	1	1			2		1					63	11.87	18.8
Sept.	1900	5	22	18	4	2	2	1			1		1			1		1					58	10.72	18.5
Oct.	1900	2	12	12	2	1	1	1										1					32	5.85	18.3
Nov.	1900	2	7	5	2	1	1											1					19	3.52	18.5
Dec.	1900	2	6	5	2	1												1					17	3.14	18.5

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FIG. 3—AVERAGE RATES OF WAGES PER HOUR PAID TO MISCELLANEOUS LABOR

Average Hourly Wage Rate.

In Fig. 3 is shown a card on which is entered the average rate per hour paid the operating force, as well as the number of men employed and their respective wages per hour. When business is dull and it becomes necessary to decrease the forces in the various departments, it is customary for the foremen to hold their most skilled employes and, as a rule, these workmen are paid the highest wages. Undoubtedly, this is the best method to pursue, but unfortunately it will greatly increase the operating cost. While the men in charge of the various departments are endeavoring to decrease the operating force in proportion to the output, they are holding the skilled employes receiving the highest wages and, as a result, the average rate per hour increases. This is readily explained. For example, if it is found that 24 men are receiving 22 cents per hour and 24 men are being paid at the rate of 30 cents per hour, and after discharging 20 of the men who were paid at the rate of 22 cents, there will be left four men receiving 22 cents per hour and 24 employes at the rate of 30 cents. The average rate per hour, therefore, increases. This, of course, is a legitimate reason for an increase in the cost of labor and the figures will indicate this clearly. This card will also prove of value when hiring men, as it indicates the rate they can most consistently be paid. The information contained on this card can also be elaborated to include the different departments with one

card for each class of labor, as the card, shown in Fig. 3, covers the miscellaneous labor only. In the last column is given the average rate per hour, but the actual number of men employed is not included and this card must not be considered for that purpose.

In Fig. 4 are shown the average rates per hour paid the different classes of labor, the data for this card being obtained from the card, shown in Fig. 3, and other similar cards maintained for the different classes of labor. In the last column is given the average rate per hour for all of the labor employed and it will be noted that there was a gradual increase in the hourly rate from 22.2 cents in January to 25.6 cents in December. These averages clearly indicate the trend of labor costs.

AVERAGE RATES PER HOUR IN CENTS

SEMI-MONTHLY

MONTH	YEAR	MOLDERS	CORE'M	CHIPPERS AND GRINDERS	LABORERS	PATTERN MAKERS WOOD	PATTERN MAKERS METAL	CARPENTERS	MACHINE REPAIR	ELECTRICAL WORKERS	WATCH JANITOR & ELEVATOR	CRANES	BLACKSMITH	TIMERS		TOTAL AVERAGE RATE PER HOUR
Jan.	1900	28.3	19.5	18.7	17.4	34.5	28.8	25	27.4	26.5	16.2	22.4	20.8	27.2		22.2
Feb.	1900	28.2	19.6	18.7	17.3	34	28.8	24.8	27.1	23	16.2	22.6	21	26.5		22.1
Mar.	1900	28.2	20	18.9	17.5	34	29.1	25	27	23.3	16.1	22.5	20.8	26.5		22.3
Apr.	1900	28.5	20.3	18.9	17.5	34.3	29	25.5	27.5	23.3	16.2	22.7	20.8	26.5		22.7
May	1900	30.0	21.2	19.1	17.7	33.5	27.2	25.9	27	23.3	16.2	22.5	21.2	27.8		23.2
June	1900	30.6	22.1	19.1	17.8	33.7	27.2	26.1	27.1	23.6	16.7	22.5	21.2	27.8		23.9
July	1900	30.7	22.2	19.4	18	34.6	28.2	26.5	27.5	23.6	16.7	22.6	21.2	27.8		24
Aug.	1900	31.3	23.2	19.5	18.1	35.7	28.1	27.2	27.8	23.5	16	22.6	22.5	32		24.5
Sept.	1900	31.2	23.3	19.9	18.3	34.9	28.3	27.2	28.7	23.5	16.2	22.6	22.5	32		25.2
Oct.	1900	32.0	24	19.8	18.4	35.0	28.5	29	28.7	23.4	16.1	22.6	22.8	31.5		25.2
Nov.	1900	32.5	23.6	19.9	19.1	31.7	28.2	29	29.3	23.4	16.5	22.8	22.7	31.5		25.4
Dec.	1900	32.0	24.2	20.1	18.9	31.8	28.2	30.3	30.2	23.5	16.5	23	22.5	31.5		25.6

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FIG. 4—AVERAGE RATES OF WAGES PER HOUR

Efficiency Sheet.

In Fig. 7 is shown an efficiency sheet of the various foundry departments, which will prove an excellent check on the molders and their work. This sheet should receive the careful consideration of the foundry superintendent and is one of the most important of this entire system. It proves an absolute check on each molder and the difficulty of obtaining this information has thus far been one of the weak points in foundry accounting. Bad castings are constantly made in every foundry, but unfortunately they are not properly charged against the departments accountable for this defective work. The foreman has a knowledge of the number of bad castings produced, but the actual number is rarely recorded in the office, as he fears it might reflect upon his record. Furthermore, a foreman is occasionally interested in protecting some of his molders, who may be close friends and whose defective work may be large and yet may not be properly recorded. The efficiency sheet eliminates this and prevents the foreman from showing any favoritism. On this sheet is recorded the molders' name, as well as his check number. Both of these items are recorded on this sheet to enable the foreman to get better acquainted with his men. Spaces are provided for the total pounds of metal poured, pounds of defective castings and the percentages of good castings and bad castings are also entered. In another space is entered the percentage of defective castings in excess of the department average. This is the most important feature of this record and it indicates at a glance the molders that are exceeding the floor average for defective work. It will be noted that in department A, the percentage of defective castings is 9.3 per cent; in department B, the average of defective castings is only 7.3 per cent, whereas in department C, the average is only 3.6 per cent. This efficiency sheet clearly indicates the molders that are responsible for increasing the average of defective castings. It will be noted that J. Smith, check No. 1, exceeded the average of department A for defective castings by 7 per cent; check No. 4, 1 per cent; check No. 9, 3 per cent; check No. 10, 18 per cent; check No. 13, 5 per cent; check No. 15, 16 per cent; check No. 17, 15 per cent; check No. 20, 8 per cent; check No. 21, 2 per cent; check No. 22, 14 per cent. It will also be gratifying to note that in department A, the molders holding checks, Nos. 3, 5, 8, 11, 18 and 23, made no defective castings during the first half of the month. In department B, the average of defective castings is 7.3 per cent, and it will be noted that it was exceeded by check No. 39 by 5 per cent; No. 41, 5 per cent, and No. 44, 7 per cent, etc. In department C, the average of defective castings was only 3.6 per cent, and molders holding checks, Nos. 74, 83 and 91, had losses of 15, 17 and 12 per cent, respectively, in excess of the department average.

Attention is, therefore, immediately directed to the men who keep up the department average of losses and thereby increase the cost. It is possible that these men are favorites of the various foremen, but probably they had good reasons for the poor work and during the succeeding two weeks a complete reversal in their work might be recorded. However, if their percentage of defective castings still exceeds the department average, a change should be made. In addition, this efficiency sheet affords an excellent comparison of the work of the foremen in charge of the various floors. It is the constant aim of each foreman to have the lowest

CHECK No. 62 NAME—F. WILLIAMS

DATE	POUNDS POURED	POUNDS BAD	% GOOD	% BAD	% OVER	DATE	POUNDS POURED	POUNDS BAD	% GOOD	% BAD	% OVER
1/15/00	2306	402	84	16	5	5/31/00	6212	0	100	0	0
1/31/00	4526	235	95	5	0	6/15/00	4080	0	100	0	0
2/15/00	5483	0	100	0	0	6/30/00	4900	1453	64	36	29
2/28/00	2869	239	92	8	0	7/15/00	7060	0	100	0	0
3/15/00	4118	169	96	4	0	7/21/00	7343	570	92	8	0
3/31/00	3746	1114	71	29	18	8/15/00	3420	0	100	0	0
4/15/00	4056	589	86	14	3	8/31/00	574	34	94	6	0
4/30/00	5069	561	89	11	1						
5/15/00	5649	509	91	9	0						

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FIG. 5—MOLDER'S EFFICIENCY RECORD

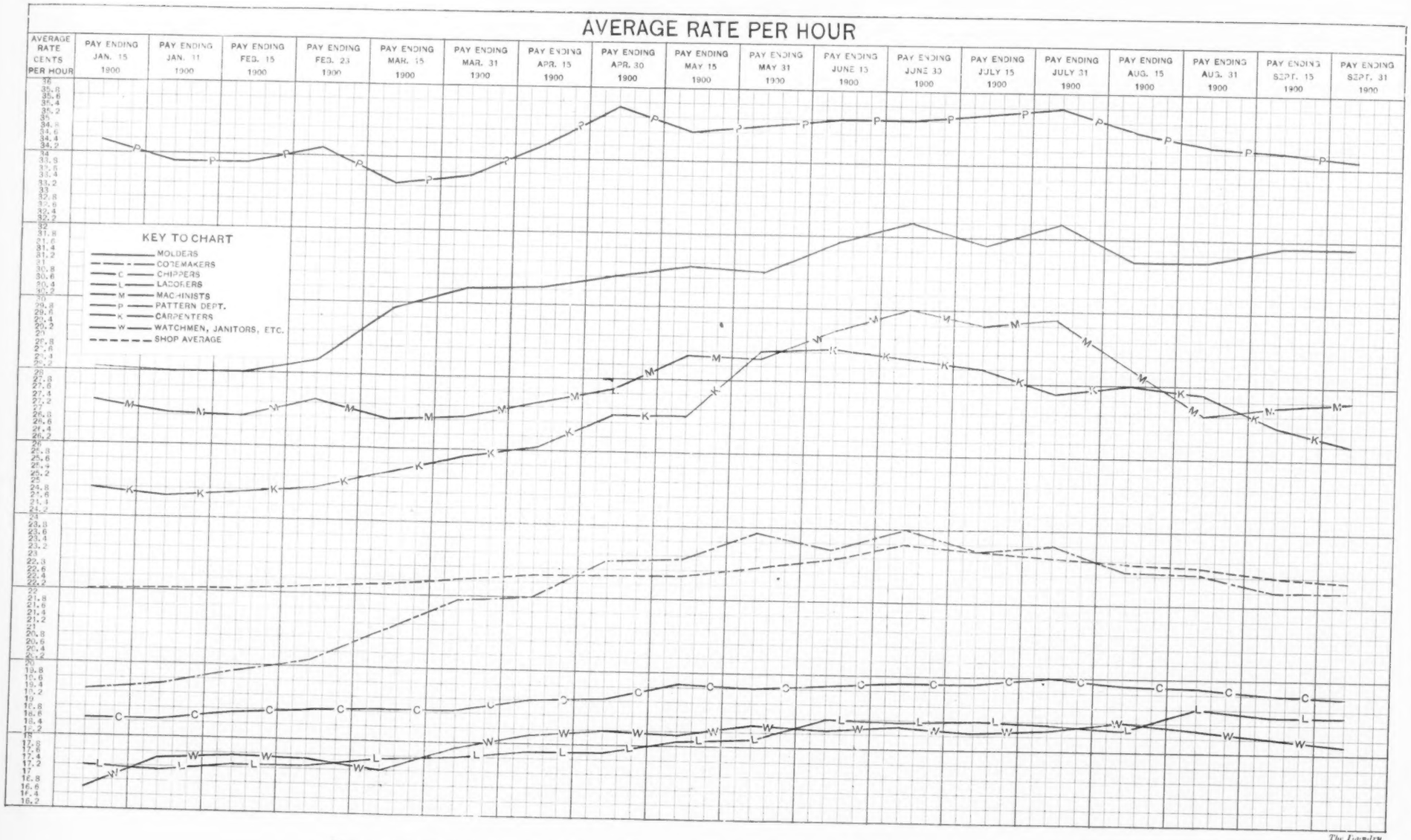

AVERAGE RATE PER HOUR
AVERAGE RATE CENTS PER HOUR
PAY ENDING JAN. 15 1900
PAY ENDING JAN. 31 1900
PAY ENDING FEB. 15 1900
PAY ENDING FEB. 23 1900
PAY ENDING MAR. 15 1900
PAY ENDING MAR. 31 1900
PAY ENDING APR. 15 1900
PAY ENDING APR. 30 1900
PAY ENDING MAY 15 1900
PAY ENDING MAY 31 1900
PAY ENDING JUNE 15 1900
PAY ENDING JUNE 30 1900
PAY ENDING JULY 15 1900
PAY ENDING JULY 31 1900
PAY ENDING AUG. 15 1900
PAY ENDING AUG. 31 1900
PAY ENDING SEPT. 15 1900
PAY ENDING SEPT. 31 1900
KEY TO CHART
MOLDERS
COREMAKERS
C CHIPPERS
L LABORERS
M MACHINISTS
P PATTERN DEPT.
K CARPENTERS
W WATCHMEN, JANITORS, ETC.
SHOP AVERAGE
The Foundry

FIG. 6—CHART, SHOWING THE AVERAGE RATES OF WAGES PER HOUR FOR A PERIOD OF NINE MONTHS

defective casting record, and it is to his interest to employ such skilled help as will enable him to maintain a good department average. The molder is, of course, not always to blame for defective work, as poor rigging, defective cores and improperly made patterns will frequently cause difficulties for the most skilled molder. This report, however, will immediately direct the foreman's attention to the molders producing defective work in excess of the department average and will enable him to immediately assist the molder in overcoming his difficulties.

Molder's Record Card.

Fig. 5 is a card, showing the record of each molder, the data being posted from Fig. 7. This clearly shows the efficiency of the molder. On this card is recorded the record of F. Williams, covering a period of nine months. It will be noted that his average of defective castings is below the department average for 16 of the 18 semi-monthly periods. The card further shows that he only twice exceeded the department average for defective castings. If this molder asks for an increase in wages, it is not necessary to consult the foreman as to whether an increase should be granted. The card contains all of the necessary data and it is apparent from the card, shown in Fig. 7, that F. Williams has more than maintained the average for his floor. Furthermore, this card record will enable the superintendent to select his man, and if after a period of depression the shop force is again being increased, it affords him an opportunity of selecting only the most skilled molders from the card records, showing their previous period of employment.

Chart of Average Wages.

In Fig. 6 is illustrated a chart which effectively shows the average rate of wages paid molders, coremakers, chippers, laborers, etc., in half-monthly periods. This chart covers a period of normal operation, gradually reduced output, with a return to normal conditions in the latter part of 1900. The high points show an increase in the average wage rates per hour produced by retaining the men receiving the highest wages while the production is low, and the curves gradually drop as the output is increased, indicating that the force has again been increased and that workmen are again being employed at lower wage rates. The dotted line shows the shop average per hour and is a basis for making quotations when the shop output is declining.

The L. W. Pond Foundry & Machine Co., Worcester, Mass., is building a foundry, 66 x 261 feet.

Analysis of Car Brasses

The following analysis of a car journal bearing, picked at random from a pile of scrap brass, shows that the composition of the alloy, though fairly good for the purpose for which it was intended, would have been unsuited for any but the cheapest castings. This was due to the large amount of oxide that it contained, not given in the analysis, but clearly evident in the fracture. The analysis was as follows: Copper, 71.8 per cent; lead, 10.2 per cent; zinc, 10.3 per cent; tin, 6.9 per cent, and antimony, 0.8 per cent.

The bearing probably was cast direct from red brass borings, a material peculiarly susceptible to oxidation, owing to the large surface area exposed to the oxidizing influence of the furnace gases. In melting borings it is advisable to add from 1 to 3 per cent of phosphorus to clean the metal, although this is rarely done in making the common grade of car brasses. However, such an addition would greatly improve the casting for bearing purposes, provided it was the intention to produce a casting free from porosity. If the oxidation has proceeded sufficiently far to make the castings spongy, or so that they are filled with innumerable small holes, it is a question whether a better bearing would not result, in a metal of this composition, than if it were cast solid, because after the hard lead lining is cut away, the holes in the brass would absorb the oil. In practice, a spongy car bearing has been known to give excellent service with no trouble from heating, and when worn out, investigation proved it to be a metallic sponge, the interstices of which are filled with oil.

EFFICIENCY SHEET
DEPT. A.
FIRST HALF - MARCH, 1900
J. JACKSON - FOREMAN

CHECK NO.	NAME	POUNDS POURED	POUNDS BAD	% GOOD	% BAD	% BAD OVER DEPT AVERAGE
1	J.Smith	2872	502	83	17	7
2	T.Williams	5255	210	96	4	—
3	F.Thomas	2889	0	100	0	—
4	etc.	6337	711	89	11	1
5	etc.	2289	0	100	0	—
6		4770	210	96	4	—
7		4802	343	93	7	—
8		5229	0	100	0	—
9		5920	800	87	13	3
10		1783	492	72	28	18
11		3050	0	100	0	—
12		6220	290	95	4	—
13		4560	720	85	15	5
14		2201	115	95	5	—
15		2416	624	74	26	16
16		3220	170	95	5	—
17		6200	1560	75	25	15
18		5330	0	100	0	—
19		7160	201	98	2	—
20		5280	960	82	18	8
21		5880	711	88	12	2
22		4939	1185	76	24	14
23		6100	0	100	0	—
	Total	104783	9805	90 1/2	9 1/2	

EFFICIENCY SHEET
DEPT. B.
FIRST HALF - MARCH, 1900
G. ABBOTT - FOREMAN

CHECK NO.	NAME	POUNDS POURED	POUNDS BAD	% GOOD	% BAD	% BAD OVER DEPT AVERAGE
35	T.Jones	3229	101	97	3	—
36	F.Burk	1851	150	92	8	—
37	T.Phillip	4775	190	96	4	—
38	etc.	2750	172	94	6	—
39	etc.	3305	431	87	13	5
40		4740	95	98	2	—
41		3305	431	87	13	5
42		1563	83	95	5	—
43		372	18	93	7	—
44		1087	164	85	15	7
45		2840	235	92	8	—
46		2048	87	96	4	—
47		5257	162	97	3	—
48		3215	435	87	13	5
49		2825	506	81	19	11
50		4161	185	96	4	—
51		3557	435	88	12	4
52		5717	482	92	8	—
53		3215	435	87	13	5
54		1543	56	97	3	—
55		1389	172	88	12	4
56		2799	91	97	3	—
57		1925	166	97	3	—
58		4161	185	96	4	—
	Total	71903	5181	92 7/10	7 3/10	

EFFICIENCY SHEET
DEPT. C.
FIRST HALF - MARCH, 1900
J. PHILLIPS - FOREMAN

CHECK NO.	NAME	POUNDS POURED	POUNDS BAD	% GOOD	% BAD	% BAD OVER DEPT AVERAGE
71	J.Smith	4276	418	91	9	5
72	T.Opp	5739	395	94	6	2
73	etc.	3227	0	100	0	—
74	etc.	5232	522	81	19	15
75		8885	0	100	0	—
76		3848	0	100	0	—
77		3750	0	100	0	—
78		3948	0	100	0	—
79		3511	0	100	0	—
80		6795	0	100	0	—
81		5533	255	96	4	—
82		4590	0	100	0	—
83		9106	1983	79	21	17
84		1982	320	94	6	2
85		6413	0	100	0	—
86		5628	0	100	0	—
87		783	0	100	0	—
88		4760	0	100	0	—
89		5501	0	100	0	—
90		5236	0	100	0	—
91		3525	575	84	13	12
92		4183	168	97	3	—
93		4119	0	100	0	—
94		5840	0	100	0	—
95		6676	0	100	0	—
	Total	127531	4639	96 1/2	3 1/2	

The Foundry

FIG. 7—EFFICIENCY SHEET FOR THREE FOUNDRY FLOORS

A Large Gray Iron Shop for Light Work

Description of the International Harvester Co.'s Milwaukee Foundry

IN THE design of large machine shops it has been customary for many years to provide galleries or second floors in the side bays for the installation of light machine tools, thus greatly increasing the effective floor space and the capacity of the shop with no increase in ground area and but little additional expense. Foundry engineers have usually avoided this type of construction, since it is generally considered unsatisfactory to conduct molding operations on any other than the ground floor. There is no real reason, however, why foundries cannot be operated economically using second floors or galleries to increase both the available molding space and the output, provided the facilities for handling materials, including sand, iron, flasks, castings, etc., are adequate and properly designed. After a careful study of the particular problem at hand by the local management, the International Harvester Co. built its new foundry at the Milwaukee plant with a gallery running the full length of the side bay, thus increasing the molding floor area 50 per cent without introducing any difficulties of moment in the operation of the shop. In addition to the gallery in the side bay, this shop has a number of other features of interest, including elaborate sand storage and handling facilities, a carefully worked out system of cranes, hoists, trolleys and surface tracks for the transportation of materials within the plant and well arranged charging floors and iron storage yards.

The foundry produces gray iron castings exclusively and is a recent addition to the Milwaukee works of the International Harvester Co. This plant is an outgrowth of the old Milwaukee Harvester Works, and is now devoted entirely to the manufacture of gasoline engines, cream separators and tractors. The foundry is called upon to make a wide

FIG. 1—GALLERY MOLDING FLOOR, SHOWING THE MONO-RAIL HOIST OVER THE HATCHWAY

FIG. 2—MAIN BAY OF THE FOUNDRY

variety of gray iron machinery castings in large quantities. Most of the castings are comparatively light and none would be classed as heavy in modern foundry practice. Practically the heaviest piece made is an engine bed which will not weigh over a ton, while the average casting turned out in the shop does not weigh over 25 pounds. The new shop is on the west side of the plant, just west of and parallel to the old foundry, which is being converted into a machine shop. Adjoining the new foundry on the west is a city park which limits the space available for the plant. The confined area naturally had an effect on the design of the new foundry and was one of the factors influencing the construction of the side gallery in order to increase the size of the molding floor. The shop is situated at the foot of a side hill so that considerable excavation was necessary in order to obtain a level plot of ground on which to erect the building and gantry cranes. It was necessary to build a concrete retaining wall at the south end of the property where the excavation is deepest.

The building proper is 779 feet long and 150 feet wide, divided into two bays or aisles, each 75 feet wide. The structure has a steel frame and brick curtain walls with a saw tooth, glazed roof. Particular care has been taken in the design of the building to admit an abundance of natural light. The roof is practically all glass and the windows occupy 60 per cent of the wall space.

Figs. 2 and 3 show the interior of the shop and give a clear idea of its general arrangement. The main aisle, 665 x 75 feet, is used for floor molding and for producing the heavier castings. This bay is 40 feet high from the floor to the bottom chords of the roof trusses

FIG. 3—MAIN BAY OF THE FOUNDRY, SHOWING THE TRAVELING AND WALL CRANES

FIG. 4—A VIEW OF THE GALLERY MOLDING FLOOR

and the runway for the main cranes is about 34 feet from the floor. The side bay, which is shown at the right in Fig. 2 and at the left in Fig. 3, is also 665 feet long and 75 feet wide and contains a gallery or second floor, 22 feet above the main floor. This gallery runs the full length and half the width of the building and, therefore, adds 50 per cent to the molding floor area. Fig. 4 shows the general arrangement of the gallery floor, which is used for bench molding, snap flask and other light work. The cupolas are arranged in two groups on the west side of the shop, opposite the gallery, as shown in Fig. 8. Three large sand bins have been constructed on the west side of the building, as shown in Fig. 8. The two end bins are each 114 feet long by 40 feet wide and are used for the storage of molding sand; the middle bin is 209 x 40 feet and is used for the storage and preparation of core sand. Fig. 7 shows an interior view of one of the sand bins. Each bin is 16 feet deep and the floor is about 10 feet below the level of the main floor of the shop and of the storage yard, the roof being, therefore, about six feet above the ground level. The bins are constructed of reinforced, waterproofed concrete with concrete roofs having a slight slope to the west in order to drain off rain water. The three bins have a combined capacity of 15,000 tons of sand. In the roof of each bin are sliding watertight hatches which are opened when the bin is to be filled. A spur track runs alongside the bins so that cars may be spotted conveniently. The middle bin, containing core sand, is equipped with two rotary sand mixers, driven by electric motors.

To distribute the sand economically from the bins to the various points throughout the shop where it is used, a system of tunnels has been built underneath the shop on a level with the

FIG. 5—GANTRY CRANE AND LIFTING MAGNETS IN THE PIG IRON STORAGE YARD

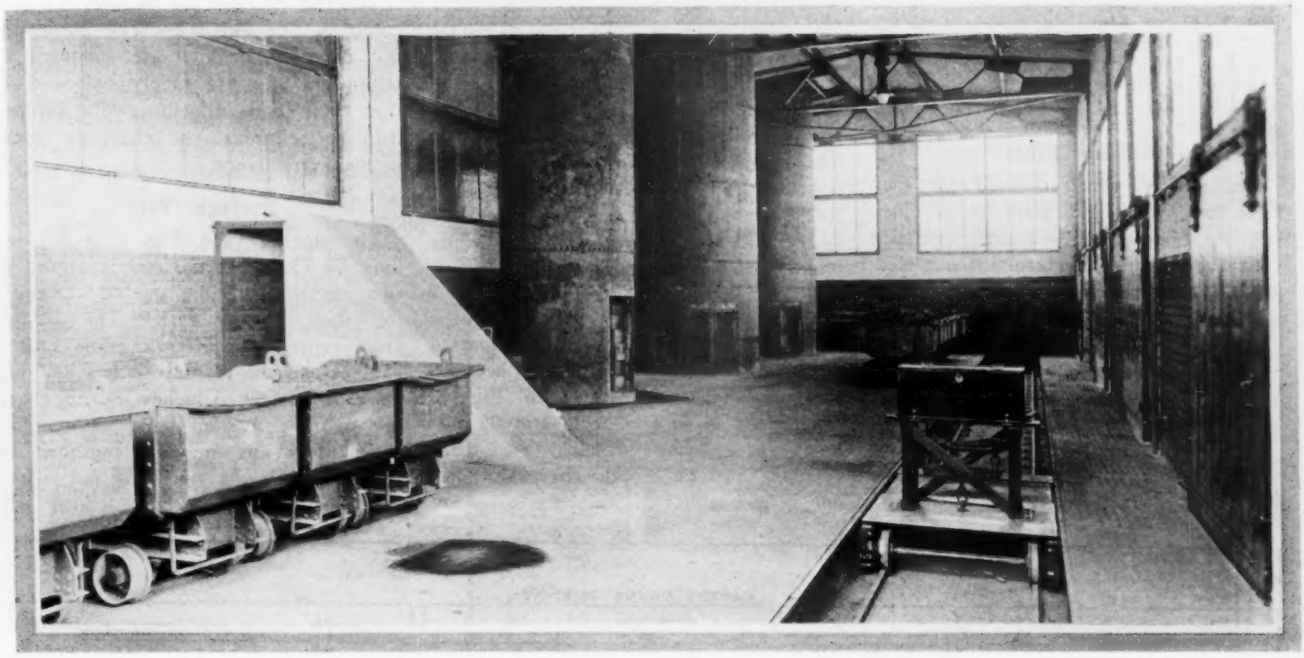


FIG. 6—CHARGING FLOOR, SHOWING THE TRANSFER SCALE AND CHARGING BUGGIES

floor of the bins. One tunnel, as shown in Fig. 8, runs the full length of the building, directly in front of the bins, while another runs across under the middle of the structure to an elevator just within the east wall. The tunnels are provided with 24-inch gage tracks which have turnouts entering each bin and small hopper cars propelled by hand are used to carry the sand. By means of the elevator, either core or molding sand may be conveyed to the second floor or to the side bay on the first floor and distributed. To facilitate the distribution of sand in the main bay, there is a large hatchway at each end of the long tunnel in front of the bins, as shown in Fig. 8. This makes the tunnel accessible by the main traveling cranes and cars of sand can be picked up bodily and dumped at any point on the floor which may be desired. The tunnels are lighted by individual, enclosed incandescent lamps and are carefully drained to keep out moisture.

The economical transportation of materials throughout the shop has been given careful consideration. As shown in Figs. 2 and 3, the main bay is equipped with three 71-foot span, 10-ton electric traveling cranes, built by Pawling & Harnischfeger Co., Milwaukee, and with five, five-ton, Pawling & Harnischfeger electric traveling wall cranes. The cranes travel the full length of the shop. The side bay under the gallery is used for light floor molding and is divided by the building columns into floors, 19 feet wide and 75 feet long. Each of these floors is provided with a light, two-ton traveling crane of 17-foot span, equipped with an air hoist for handling flasks, as shown at *C*, Fig. 2. As shown in Figs. 2 and 3, the runways for these side bay cranes are carried out about 4 feet into the main bay so that connection may readily be made with the main traveler or with the wall cranes.

FIG. 7—LARGE SAND BIN FOR STORAGE AND PREPARATION OF MOLDING SAND

Departments which produce comparatively light castings have most frequent use for a crane and for this reason each floor under the gallery is provided with its own crane and air hoist.

Gallery Floor.

The gallery, which is used for snap flask and other light work, is provided with an I-beam trolley system, equipped with five Pawling & Harnischfeger electric traveling mono-rail hoists, as shown in Figs. 1 and 4. These hoists are used principally for handling sand and hot metal and for conveying finished castings to the cleaning rooms, which are located at either end of the building.

As shown in Fig. 8, there are two hatchways or shafts cut through the gallery at each end, through which materials may be hoisted from the main floor. Branch loops in the mono-rail system lead over these hatchways and in Fig. 1 one of the mono-rail hoists may be seen poised over a shaft, ready to drop its hook to pick up a load below.

Industrial Railway.

In addition to the overhead crane equipment, the entire plant, including the storage yards, is traversed by a 24-inch gage industrial railway which, with the elevators between the floors, forms a connected, useful auxiliary system of transportation. This supplements the crane service and may be used in its stead in case of necessity.

Crane ladles suspended from the main travelers or the wall cranes are used to distribute hot metal about the main bay when pouring. To convey molten iron to the gallery floor, a system of truck ladles, which may be seen in front of the cupolas, Fig. 2, is used. The tracks on which these truck ladles run lead under the hatchways in the gallery floor so the ladles can be lifted off their trucks by the mono-rail hoists, operating in the gallery and carried to the proper points on the second floor for pouring.

Melting Equipment.

The two charging floors are located on the west side of the building, between the sand bins, as shown in Fig. 8. Each floor is 40 feet wide and 95 feet long, space being provided for three cupolas. At the south charging floor, one 78-inch and two 96-inch cupolas are installed. Blast for each battery of cupolas is supplied by one No. 7½ and two No. 6½ Roots positive pressure blowers. The charging floors are served by a gantry crane spanning the iron yard and are also equipped with elevators for handling material.

The pig iron, coke and scrap may be handled by either of two methods. The gantry crane is provided with lifting magnets which can pick up pig or scrap from the piles and place it directly on the charging floor, and may also be used to handle charges of coke, or the material may be loaded onto trucks, which run on the 24-inch tracks traversing the yard and conveyed to the charging floor elevators. Each charging floor is provided with a movable platform scale, on which the charges are weighed as they come to the cupolas. The bodies of the charging buggies are mounted on trunnions and are nicely balanced so that their loads may be easily dumped into the cupolas, the charging doors being extra large.

Storage Yard.

The storage yard, Fig. 5, is 800 feet long by 75 feet wide, and is served by two electric traveling gantry cranes of five tons capacity each. The distance from center to center of crane rails is 75 feet and the crane also has an overhang of 12 feet, 6 inches over the charging floors and sand bins. A standard gage track runs the full length of the yard alongside the sand bins and is used for the delivery of cars loaded with sand, coke, pig iron or scrap. In addition to the standard gage track and the gantry crane, the storage yard is also provided with 24-inch gage industrial tracks which reach all points of the yard and connect it with the interior of the shop.

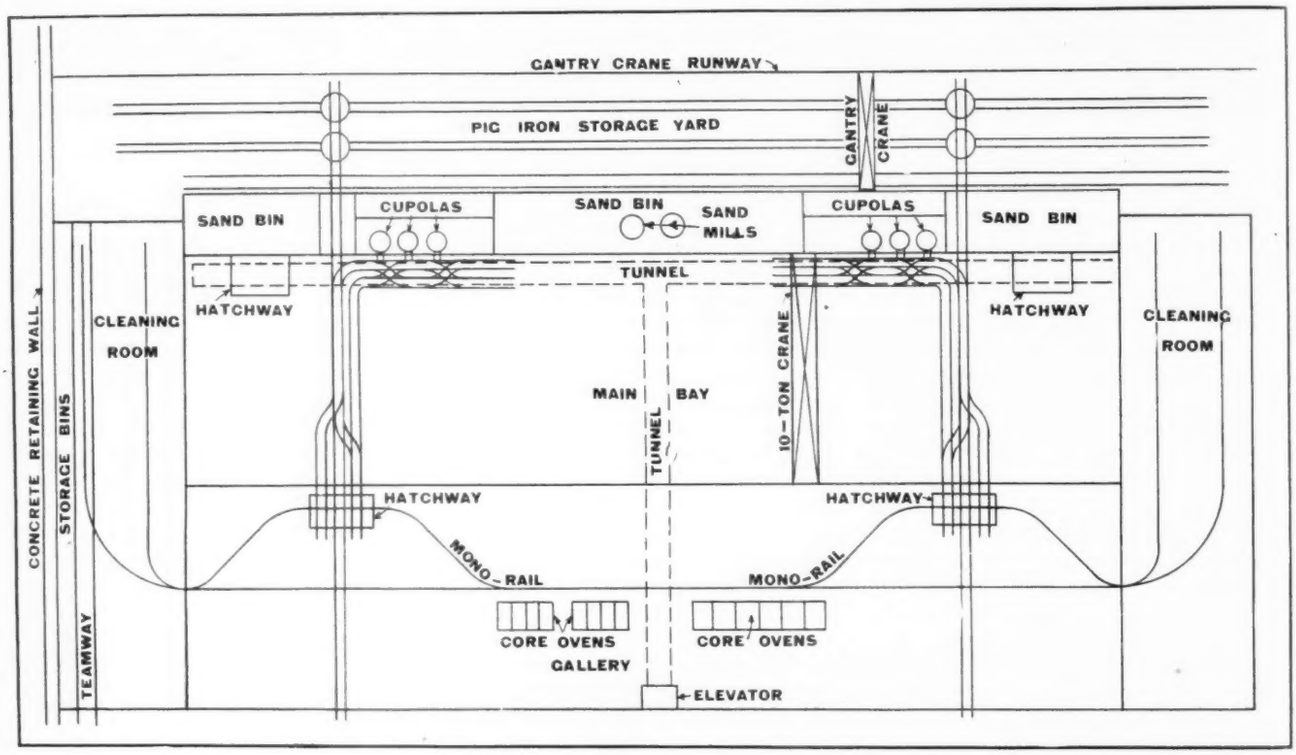


FIG. 8—PLAN VIEW OF THE INTERNATIONAL HARVESTER CO.'S MILWAUKEE FOUNDRY

Core Department.

The core ovens are situated on the first and gallery floors, near the middle of the side bays at a point convenient to the main molding floor and to the elevator connecting with the gallery. On the first floor is one battery of nine Whiting car ovens with cars 5 x 8 feet and another battery of 12 Whiting shelf ovens, arranged in groups of four. On the gallery floor are eight Whiting shelf

ovens, arranged as on the ground floor and space is reserved for the future installation of eight additional ovens. The core room equipment and practice is standard in every respect.

As shown in Fig. 2, the main bay is devoted to floor molding, producing the heavier castings, such as engine beds, fly wheels, heavy cylinders, etc. Solid cast iron flasks are used and practically all the molding is done by machine. The molding machine equipment was furnished by Henry E. Pridmore, Chicago, and consists of rock-over-draw and stripping plate machines, both round and square. The molding practice is standard and presents no unusual features. As suggested above, the side bay under the gallery is used for light floor work on machines and the gallery is reserved for snap flask and bench work. The arrangement of the floors on the gallery is clearly shown in Fig. 1.

Cleaning Departments.

There are two cleaning departments, one at each end of the building, as shown in Fig. 8. Each department has two floors, the upper floor being on a level with the molding gallery. Each floor is provided with batteries of motor-driven tumblers. On the first floor, cranes and industrial tracks connect the molding bay with the cleaning room and on the second floor the mono-rail system is used for the same purpose. Elevators connect the first and second floors of the cleaning rooms. At the south end of the building, a row of bins for the storage of small castings is built against the retaining wall and in front of the bins is a roadway connecting the foundry to other parts of the plant.

In the middle of the building, under the gallery, is a mezzanine floor, containing the office of the foundry and locker and wash rooms. Additional locker and wash rooms are located at the north and south ends of the building.

Two rows of 10-ampere flaming arcs, spaced 38 feet center to center and staggered, are used to illuminate the main aisle, the lamps being suspended over the cranes, 40 feet from the floor. The side bay under the gallery is illuminated with tungsten clusters, consisting of three 60-watt lamps per cluster. Each cluster is suspended 16 feet from the floor. The gallery is similarly illuminated.

The new foundry was placed in operation Feb. 28, 1911, and an interesting program was arranged for the occasion. The employes of the plant and ladies were invited by the company to participate in the opening festivities. Light refreshments were served and music was furnished by the International Harvester the employes. In order to lend reality band, an independent organization among to the scene, the shop was in operation, and at 9:00 p. m. the first metal flowed from the new cupolas.

The foundry employes, who number about 600, in common with the workmen in other departments, are engaged in a number of co-operative activities which add materially to their enjoyment of life and improve the spirit of the organization. A lunch room is operated, where either office men or shop men may obtain a substantial midday meal at minimum expense. A feature that is worthy of note in this connection is that these enterprises are all self-supporting.

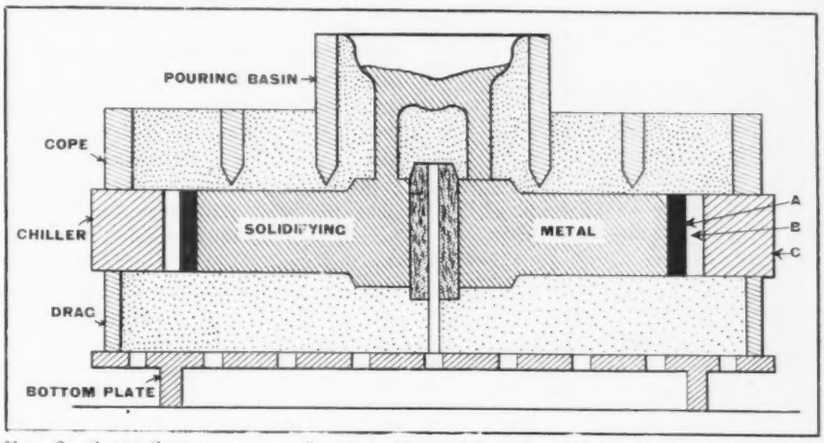


FIG. 2—CROSS-SECTION OF A CHILLED CAST IRON CAR WHEEL MOLD A FEW MINUTES AFTER POURING

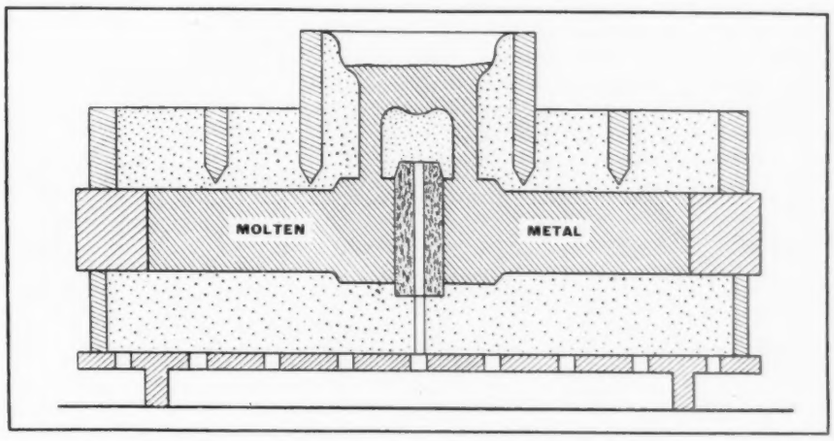


FIG. 1—CROSS-SECTION OF A CHILLED CAST IRON CAR WHEEL MOLD A FEW SECONDS AFTER POURING

Chill Cracks in Car Wheels

By Thomas D. West

Question:—We would like to know the cause of chill cracks in cast iron car wheels.

Answer:—Chill cracks in cast iron car wheels, or chilled, circular castings, are due to the internal pressure of the molten metal on the unsupported, rapidly solidifying crust or shell of metal in contact with the chills in the molds of these castings. This can be overcome by a method of positively centering the crust or shell in relation to the chiller so that it will be of a uniform depth around the periphery of the castings. It should be explained, in this connection, that the crust of iron in direct contact with the chiller will have the greatest depth of chill and that the unequal depth of chill, not only sometimes leads to the formation of chill cracks, but is also detrimental to the strength and wear of the chilled casting.

Fig. 1 shows a chill mold for a cast iron car wheel a few seconds after it has been poured. A cross-section of the mold a few minutes after pouring, showing the changes that have taken place as a result of the contraction of the crust, is shown in Fig. 2. The total contraction of a 33-inch car wheel is approximately ½ inch, while the contraction of the shell at *A*, Fig. 2, before all of the metal has solidified in the

body of a car wheel or a similar casting, is about 3/16 inch. It will be noted from the space between the interior of the chiller and the exterior of the casting, *B*, Fig. 2, that the contraction of the casting or crust and the expansion of the chiller, which is about ⅛ inch, has placed nearly all of the internal pressure of the molten metal upon the shell *A*, Fig. 2, and the chiller, *C*, could be removed entirely insofar as it affords any support to the peripheral body of the casting. Many experiments have been conducted to obtain appliances that might center and afford some support to the contracting shell of a chilled casting, to thereby aid not only in the prevention of chill cracks, but also to obtain a uniform depth of chill. Several patent chillers which, it is claimed, will hug the contracting shell of a car wheel and thereby insure a uniform depth of chill, together with other advantages, are obtainable and are to be highly recommended if they accomplish what is claimed for them.

To ascertain whether a compression chiller will tightly hug or compress the whole or any part of the body of the contracting shell of a car wheel, the drag half of the mold should be rammed as usual, but only the center or pouring basin of the cope, with its down gates, should be rammed. After ramming the pouring basin in the cope, the pattern is drawn, and if it is a plate wheel, the plate core is set with the center core as usual. The mold is then closed, clamped and poured. When filling the mold, the metal should not be permitted to rise higher than ⅜ inch below the bottoms of the cross-bars, and when this height has been reached, pouring should cease. As the cope surface of the casting is exposed to view by this method, one can ascertain, by closely watching the action of the flowing metal and the cooling crust, in a fairly reliable manner, whether the claims for these compression chillers are fully substantiated. This test would also prove interesting in not only showing how chill cracks, but also how sweats and ripples, common defects in chilled car wheels, can occur. In making this test, it should be remembered that the chiller will not be raised to so high a temperature nor expanded as much as when the cope is entirely rammed and closed over the drag. Therefore, the space at *B*, Fig. 2, will not be as great as in ordinary practice.

The chances for defects, arising from the customary practice of making chilled car wheels, are great. The unsupported or non-centered, solidifying chilled crust demands great care in the treatment of the chillers, the tempering of the sand, iron mixtures, method of melting to obtain good metal and the method of pouring. The lack of care in any of these essentials will always cause more or less trouble, which would not occur if the contracting shell could be held in the exact center of the chiller and also afforded some support.

Cement Facing

By N. W. Shed

Question:—We are engaged in the manufacture of steam cylinders, 12 inches in diameter and about 6 feet long, which have a 3-inch flange at either end. Several years ago, we used a plumbago facing and despite the fact that the iron was clean, the cylinders would leak on the cope side in the neck of the flange. We tried to overcome this by carefully-arranged runner boxes and by the use of flushing sprues, but this did not entirely overcome our difficulty. We later tried cement in place of the facing that we were using, and while the face of the cylinders were not as smooth as when the plumbago facing was used, we never lost a cylinder from leakage. Later we tried plumbago and our castings are again porous in the neck. Can you explain the reason for this?

Answer:—The cement used acted as a slight chill and closed the grain of the iron. The plumbago facing has no chilling effect and the outside skin of the casting was, therefore, comparatively porous and permitted some leakage. If you would use a harder mixture of iron, you would obtain a close grain, thereby eliminating the leakage, and when using a plumbago facing, it is considered poor practice to make cylinders of high silicon, high carbon iron. The silicon content of heavy cylinders should approximate one per cent.

Cores for Steel Castings

By R. A. Bull

Question:—We experience considerable difficulty in removing the cores from steel castings, particularly from those having small cores surrounded by a heavy section of steel. It seems that the composition of the core practically loses its identity and is replaced by a mixture of steel and silica, which is extremely hard to penetrate with cleaning tools. At times it has required four or five days to remove cores that should have been removed in several hours. We have changed our core mixture, from time to time, with little success. Analyses of the cores after such formation show an abundance of silica and steel in almost equal parts. We tried one core mixture, very rich in silica, the clay having been eliminated from the mixture entirely. We were also of the opinion that crystallization was brought about by the moisture in the core and mold and used every precaution to keep them dry. This, however, did not overcome the difficulty. We would like to have a core mixture for small cores that can be removed with the least amount of difficulty.

Answer:—In steel foundries applying the most approved methods, there is more or less difficulty in removing very small cores surrounded by very heavy sections of metal. If it were possible to make a core of silica sand alone, of the purity of about 98 per cent, there would be little difficulty. It is, of course, the foreign matter in the sand, used for bonding purposes, that fuses and causes the trouble, hence the object is to prepare a core having the least possible percentage in volume of bonding materials and at the same time having the skin of the core as free as possible from porosity. The larger the voids between the grains of sand where the steel comes in contact with the core, the greater will be the opportunity for the fluid metal to penetrate the core and fuse the non-refractory substances.

Good results have been obtained in such cases by using equal parts of new silica sand and of silica flour, tempered with molasses or glutrin, depending entirely on either of these two ingredients for the bond, using no clay, flour or dry core compound and milling the mixture very thoroughly. Finally, washing the core, when dried, with a plumbago solution, is sometimes advisable.

Difficulties With Ladle Linings

By W. J. Keep

Question:—We use a 1,000-pound bull ladle to deliver the metal to the smaller ladles on each floor. After filling three or four times the daubing on the side near the bottom invariably falls off and we have experienced considerable difficulty as a result.

Answer:—Clean the inside of your ladle and then apply clay wash with a brush. Line the ladle, using just enough clay water to hold the lining material together. The lining should then be thoroughly dried before the ladle is used. Your trouble is due to the fact that the ladle is not dried thoroughly and steam is generated between the lining and the shell of the ladle. If you use too much fire clay in the lining it will shrink and crack when drying.

MOLDING A LARGE CYLINDER IN LOAM--II

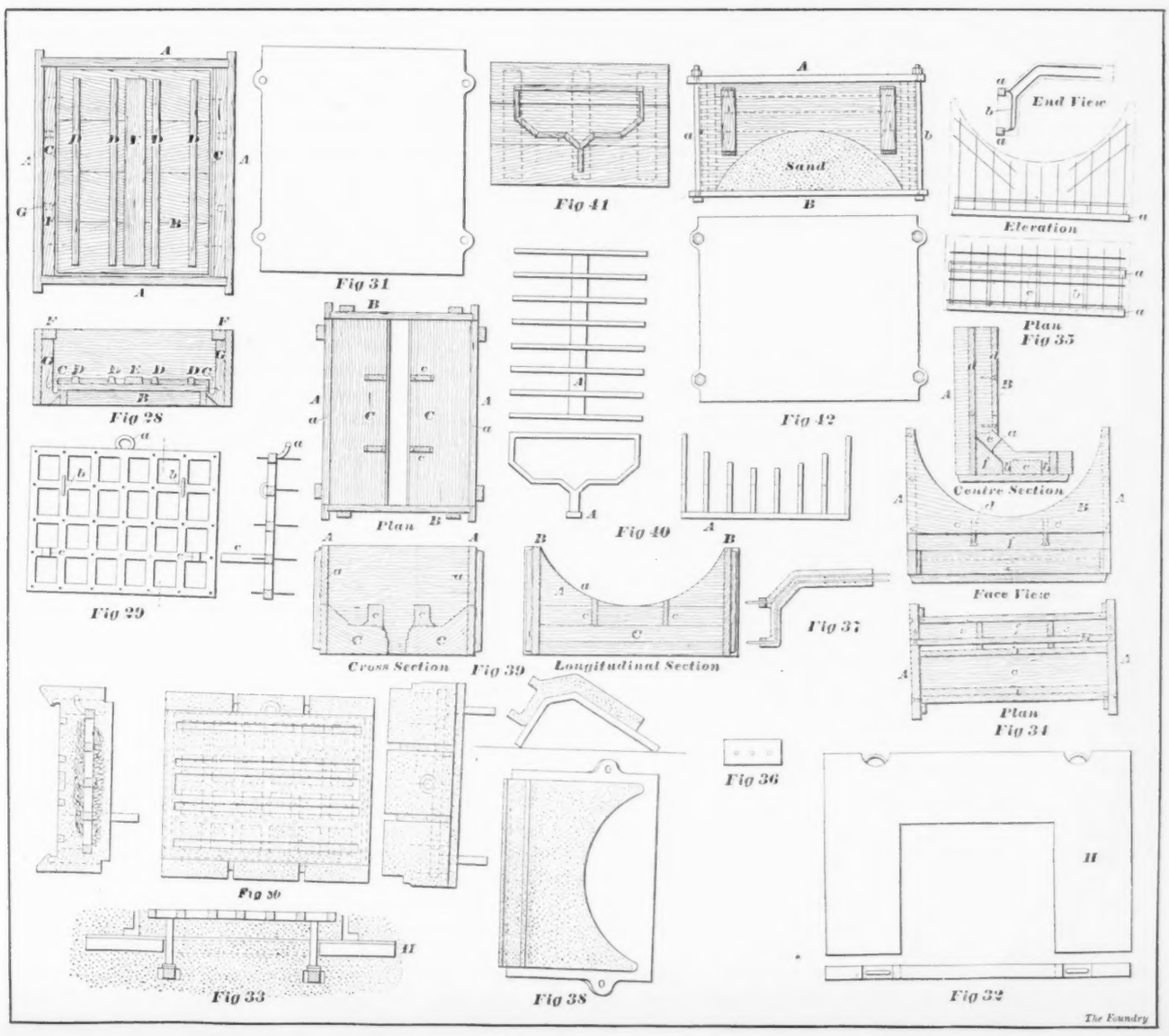
Construction of the core boxes required for the casting---Setting the cores and closing the mold

By Joseph Horner

THERE are several core boxes required for this cylinder, the most important being those for the steam chest, the steam and exhaust passages, the plain foot, and for the exhaust into the condenser. There are many interesting points of detail about these and their cores, core grids, and fastenings. The core box for the steam chest is shown in Fig. 28. It comprises the following parts: *A*, the outer frame, fitted together in the way common to most rectangular boxes, with grooved ends; *B*, the bottom, made either in one thick block or as a comparatively thin plate with ribs, as shown in this illlustration. This bottom fits exactly between the sides of the outer frame in one direction, but in the other direction the edges are beveled to give the necessary amount of metal beyond the steam passages at that point. Strips, *CC*, are skewered on the edges of the block, *B*, to form the bounding edges of the valve face. Four prints, *D*, are nailed or screwed on for the steam ports, and one print, *E*, for the exhaust port. These are narrower than the finished ports by about ¼ inch, to allow ⅛ inch on each edge for machining for the accurate cut-off of steam; *F* and *G* are internal ribs.

Continued from page 15, THE FOUNDRY, March, 1911.

Fig. 29 shows the grid for the steam chest core box. This core is heavy, and the grid is correspondingly stiff, the bars being of about 1½-inch square section. A stout eye is cast at *a*, bent to come underneath the opening in the steam chest; ⅜-inch rods are cast through the plate, standing out 5 or 6 inches on one face, projecting well into the body of the core towards the prints, and 1 inch or so from the other face toward the back of the core. The back of the grid, when in position, extends about 1¼ or 1½ inches below the face of the box. Two eyes are cast in at *bb*, to hold the core in position, hook bolts being inserted in these eyes. Two bars



are cast at *cc*. These are forced against two square bars which are inserted in holes and stand up from the bottom plate of the mold, and which prevent the core from being forced back out of position by the pressure of the metal. The core is made in green sand, the center being filled with ashes, and the margins stiffened with many lifters.

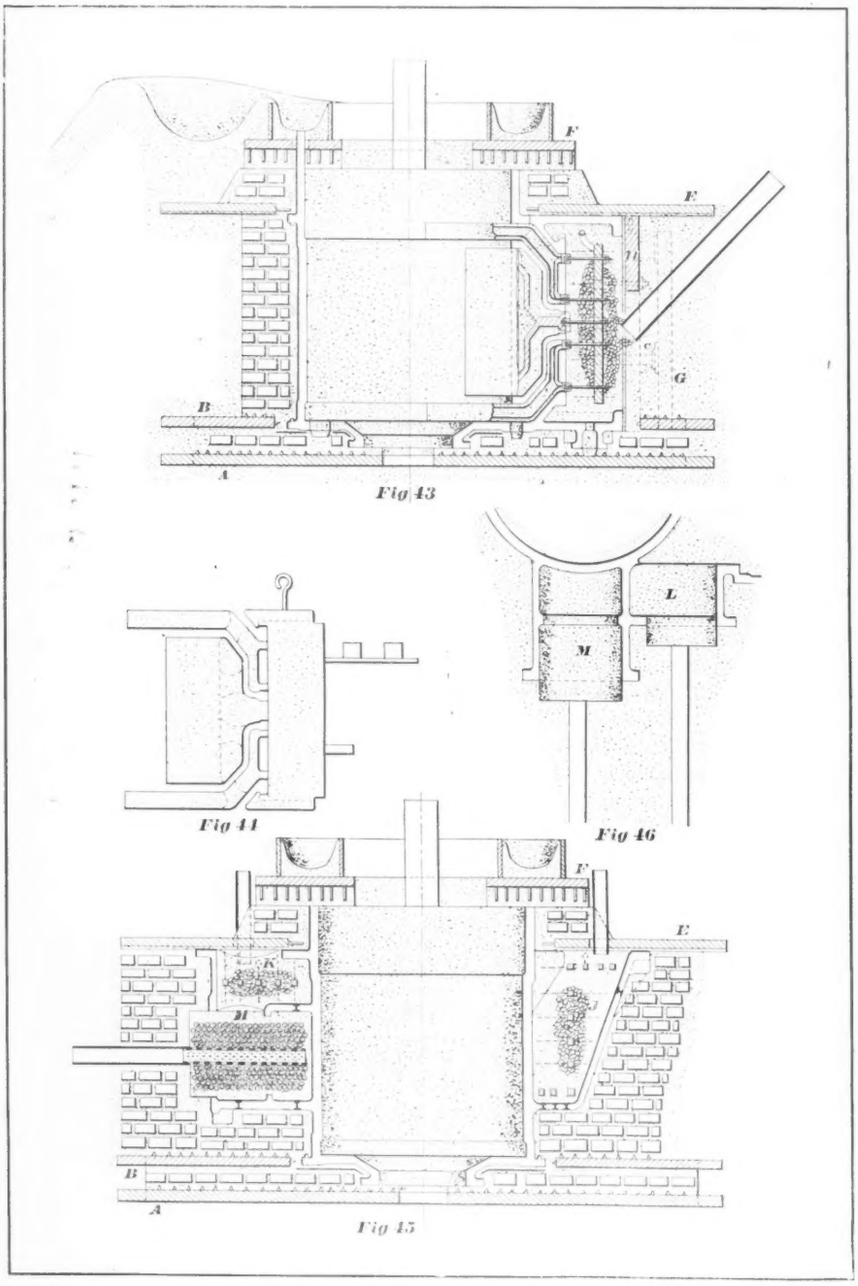


Fig 43

Fig 44

Fig 46

Fig 45

This is illustrated in Fig. 30. It is turned over on a plate, Fig. 31, on a leveled bed of sand, and the parts of the core box are then removed and the core dried on the plate. This is necessary to leave the face with the core prints open for inspection, cleaning and blacking. The core is also illustrated in Fig. 43, which shows the method of inserting the steam and exhaust cores into it, and the method of securing these cores.

The steam chest core is set in place by measurement only, that is, without a core print, as previously stated. This, of course, leaves the plain face quite exposed. This is covered with a plate, Fig. 32, the plate being extended to also cover the faces of the bricked-up mold, Fig. 33. This plate is about 3½ inches thick. The surface in contact with the mold is prodded with gaggers, and well loamed-over. There are two eyes for lifting it, and the large opening is left for the exit of the gases from the steam chest core. It is held closely against the face of the mold, either by means of screw bolts or by wedges, Fig. 43, and the joint faces are well loamed to prevent the escape of metal.

Fig. 34 shows the steam passage core box in plan, front view, and in cross-section. There are two sides, *AA*, cut on the edges, *aa*, to one portion of the outlines of the passage—the outlines which are farthest away from the exhaust passage. These edges become the guides to a plain strickle by means of which the shape of that portion of the core is imparted. The vertical portion is enclosed by a strip, *B*, to confine the sand. The distance between the sides, *AA*, corresponds to the width of the passages. The widths which form the ports, *bb*, are less than the finished widths by the allowance of ¼ inch for milling, and the bar, *c*, is wider than the corresponding bar between the ports in the finished casting by the same amount. The thickness of the bar and ports is greater than that of the casting by the added thickness of the core prints, *D*, Fig. 28. The width of the passage lying behind the ports corresponds with the width in the casting. The curve, *d*, is cut to fit the cylinder core, and the shape of that position of the core is strickled by the curved edges, *dd*. The front piece, *B*, is made so that it can be readily unscrewed and taken away to permit of the insertion of the grid. The other portions of the box are made to be unscrewed and taken away in detail after the ramming of the core is completed. The ribs, *ee*, Fig. 34, tie the metal in the passage walls together, which walls, if they were not inserted, would not remain straight, nor the passages parallel. They are nailed down to the block, *f*, and the slight radius at the delivery end is left to be rubbed off in the dried core.

Grid for Passage Cores.

Fig. 35 shows the grid made for the passage cores, in plan, elevation, and end view. Though it may seem rather a complicated grid to make, it is necessary that it should be of this form. It has to be removed after casting, and if too rigid, it cannot be withdrawn. If wholly cast, it could not be broken out; if wholly wrought, it would be too flexible. Therefore, wrought iron rods are cast into iron bars, which go into the print impressions.

Being a double-ported core, two irons, *aa*, are cast a trifle smaller than the core prints, and a number of rods are cast into these, a set of rods for each port, the two sets of rods running parallel, and terminating about 1 or 1¼ inch underneath the wider part of the core which reaches the cylinder body. These rods are ⅜ inch in diameter and are all bent to the correct shape by the

blacksmith before casting them into the bars, *aa*, the core box affording the guide, by which the bending is done. The two bars, *aa*, are then molded in open sand and the rods are set up in each, also in their correct positions, and supported against any convenient object, as a board or the side of a flask. Various other rods are disposed in a straight line and diagonally, as shown, and fastened with fine binding wire to the curved rods to prevent them from shifting. Other rods, *b*, are bent and cast into the bars, *aa*, at intervals. These maintain the bars at their proper distances from each other. These rods are also about ⅜ inch in diameter. They must be kept below the level of the core. Nuts for two screw bolts are also cast in below to help in securing the passage cores into the steam chest core. Small cores are inserted, as shown at *c*, between the rods in the bars for bringing out the strings for the core vents.

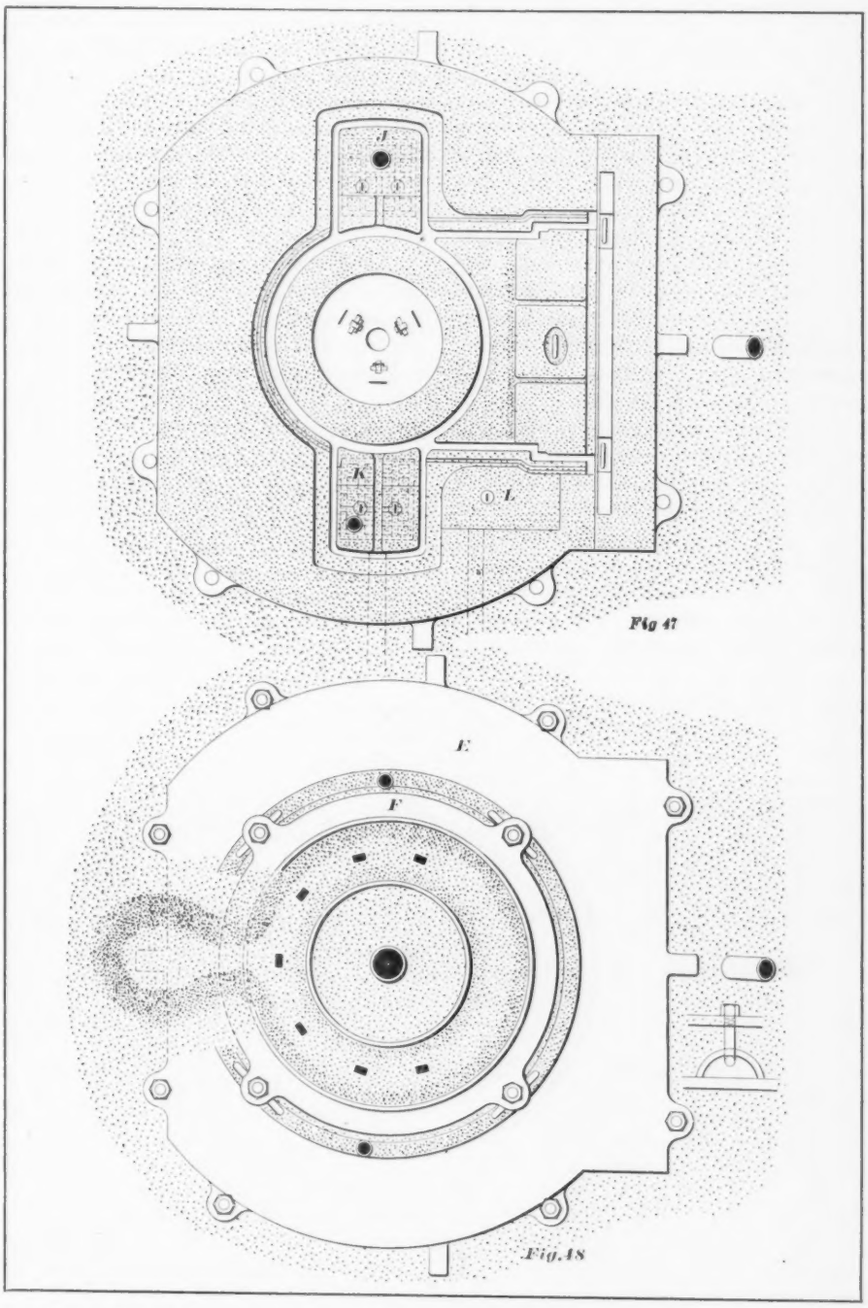
After the grids are finished by casting the bars around the lower ends of the rods, they are removed, and the cores rammed, or rather daubed up, for these large passage cores are not made in core sand, but in loam. The reason is, that though large, they are slight and apt to spring, and loam will stand more springing than core sand without risk of fracture.

Making a Passage Core.

To make a passage core, the grid is laid in position in the box, the box standing with the curved edges, which fit the cylinder body uppermost. A quantity of loam is daubed underneath and around the grid, but not enough to cover it. To keep the top free, and the ends of the rods the correct distances apart, it is necessary to secure them temporarily to one another. For this purpose a number of small cast iron plates, Fig. 36, are made, holes being cast at the same distance apart as the rods. These are slipped over the ends of the rods and are removed when the core is nearly finished.

Core ropes are next inserted carefully through the holes, *c*, and cast in the bars, *a*, Fig. 35. The locations of the holes are found by clearing away some of the loam and inserting a rod or vent wire to clear them. The ropes are about 3/16 inch in diameter, and are passed through the holes and carried up round the contour of the box between the wires. There is always a risk of the ropes coming out to the surface of the core when pulling them out, in which case metal might get in and spoil the casting. Therefore, the ropes are arranged between the longitudinal rods in such a way that the rods hold the ropes and retain them in the planes in which they have to lie. Thus, in Fig. 37, the rods with ropes are shown arranged in this way.

After inserting the ropes, the loaming-up is continued, care being taken to keep the ropes well beneath the surface of the loam, or not less than ½ inch or ⅝ inch from the surface. The loaming-up is then finished, the surface is strickled, and the whole is left to set for a night. Some fine loam is then strickled over the surface, finishing it.



Before the sides and ends of the box are removed from the core, provision is made for turning it, an awkward task in all such large, flimsy cores. In this case it is done as follows: A plate is cast, Fig. 38, about ¾ inch thick, and provided with two lugs. The plate is made without a pattern by strickling a bed, guided by means of end pieces cut to the correct form, and then strickling out the sand below this to the required thickness of the plate. This plate is laid against the face of the core, the wood of the box is then removed, and the core turned down upon the plate and dried in the stove, as in Fig. 38. The exhaust core box, Fig. 39, is framed with sides, *AA* and *BB*, enclosing two blocks, *CC*, the outlines of which correspond with the shapes and dimensions of the walls of the passage, plus the print thickness. The curved edges of the outer sides, *AA*, are cut to the radius of the body of the cylinder. The webs, *cc*, which tie the passage walls, are more advantageously

cut, as shown, parallel at the delivery end, leaving the radii to be rubbed off. If this is not done, the webs must be divided along the middle and doweled, each portion being drawn in opposite directions.

Fig. 40 shows the grid used for the exhaust core box, which is made of cast iron. The sectional area of the bars is from ⅝ inch by ⅝ inch to ¾ inch by ¾ inch. The separate parts, of which the grid is composed, are cast from a pattern, which being flimsy, is nailed upon a board, Fig. 41, and molded by bedding-in. As the depths of these parts vary in the different sections of the core, the pattern is altered from time to time. When all are cast—eight are shown in the illustration—they are united into one by casting them in a bar. The bar, *A*, Fig. 40, is a trifle shorter and narrower than the core print of the exhaust port. This is molded in open sand, and the grids are set upright and supported in it for casting, which then gives the form of the complete grid, shown in Fig. 40.

A couple of plates are required upon which the exhaust core is turned over, Fig. 42. On the plate, *A*, the core box is laid while being rammed. A bed of green sand is strickled, on which the concave portion of the core is laid, the box and plate being secured in the meantime by bolts, *a*. Then the parts of the box are removed, and the core is run into the stove and dried while lying on the bed of sand. The core is seen in position in Fig. 43.

There are several other cores, but we may omit a detailed account of these, as they are comparatively plain and are seen in position in subsequent illustrations. They include the cores for the feet, the exhausts to the condenser and to the air, and the various small cores mentioned in the previous article. We will consider now the methods of assembling, coring-up and casting.

Assembling the Mold.

Figs. 43 to 48 relate to the coring-up and completion of the mold. Fig. 43 is taken through the plane of the center of the steam chest. Fig. 44 shows the steam chest and passage cores as united. Fig. 45 is a section through the plane at right angles with that in Fig. 43, or through the center of the feet. Fig. 46 is a plan detail of the coring of the exhaust branches taken through their horizontal central planes. Fig. 47 is a plan of the cored mold as it appears when about to receive the cope. Fig. 48 is a plan of the outside of the mold.

The first stage in assembling the parts is to lay the foundation plate, *A*, Fig. 43, on a bed leveled at a suitable depth in a pit. All the various small cores are inserted in the pit as provided for in the pattern parts described in the previous article. There are the cores for the hand holes, one for the escape valve, one for the steam inlet, and one for the stuffing box to the steam chest. The last two are surrounded by a ring core to form the necks of those two branches, the ring core for the latter being seen at the right in Fig. 43.

The main central core may now be tried in to see that no hitch occurs, but it will not be inserted finally until after the outside is completed. The whole of the outer mold is carried on the plate, *B*. When it is removed from the stove, the interior has to be gone over, carefully rubbed with sandpaper, and any damaged parts repaired. The top and bottom flanges, with their shoulders and lugs for the attachment of the lagging require particular care, especially the bottom flange. This outer mold may now be laid permanently in place to receive the steam chest core and others, as shown in the illustrations.

Setting the Cores.

The cores for the steam passages and for the exhaust passage are fitted into the print impressions, formed in the steam chest core, and are secured, after having been checked over for thicknesses of metal, etc., by means of the screw bolts, the nuts for which are cast into the grids, and which, passing through the steam chest core, are tightened therein with nuts, screwed against broad washer plates, Fig. 43. Since the total weight of these cores, four in number, with their grids is very considerable, and since they are out of balance, that is, tend to fall forward towards the cylinder body, it is necessary to counterbalance them while setting them in place. For this purpose, two bars, about ¾ inch in diameter, are inserted in tapped holes near the top of the steam chest core, Fig. 44, and standing out from 18 to 24 inches, support a suitable counterbalance in the form of bars or weights. Fig. 44 shows the cores as slung in the crane. The cores being thus kept in equilibrium and perpendicular, are lowered and set without much trouble, since the molder, being relieved of the necessity of having to keep the compound core upright, is able to give his whole attention to the task of setting it truly in relation to the cylinder body.

The methods by which the steam chest core and the plate, Fig. 32, were secured in position are as follows: The oblong holes, *aa*, were cast in the bottom or foundation plate of the mold. These received square bars of iron, *C*, Fig. 43, which were inserted and tightened therein with wedges. The bars were about 2½ inches square. They extended to within 3 or 4 inches of the top of the bricked-up body, and afforded the necessary support required for the core and for the plate, *H*. These were wedged in tight and, being rigid, received the pull of the bolts from the steam chest core and formed points of resistance to maintain the necessary thrust against the covering plate, *H*, shown in Fig. 32.

On the other diameter of the mold, Fig. 45, the coring-up of the feet is shown. Cores, *J* and *K*, are rammed around suitable grids; *M* is swept-up on a bar with hay bands; *L* is rammed in a box and with its branch is lower down than *K*, being at the level of core, *M*. The sand over it is carried on a grid indicated at *L*, in Fig. 47.

The remainder of the work will be understood from the drawings. The pouring basin is contained between iron rings, the metal being first run into the basin at the left, in Figs. 43 and 48. The various vent pipes are also shown. The interior of the main core is filled with cinders. The methods of securing the plates at the top and bottom are shown, and other details, which need not be specified, are clearly illustrated.

Chilling Sled Runners

By W. J. Keep

Question:—What is the best method of chilling runners for sleds and what kind of iron should be used? If part charcoal and part coke is charged as fuel in the cupola, will the iron melt faster, and what effect will it have on the metal?

Answer:—A cast iron chill plate set in the mold is the best method of chilling the surface. Probably any mixture of machinery scrap and white pig iron will give a good chill. You can also obtain a good chill if you use stove plate without other scrap. Plow points or car wheels used in the mixture will increase the chilling tendency of the iron. I have had no experience with charcoal as a cupola fuel and would like to learn of the experience of others, who have used this fuel. It would be absolutely necessary to use sufficient coke to maintain a solid bed. Charcoal would burn so rapidly and would be crushed to a fine dust by the weight of the iron that you would be obliged to use more in weight than of coke. Charcoal is used in some instances where coke cannot be purchased, but not to any great extent. If charcoal could be used, the iron would be materially improved and the sulphur content of the mixture would not be increased in melting.

HINGED MATCH PLATES for STOVE WORK

A novel hingeless snap flask and roll-up match plate which effect great economies in the molding of stove plate

ROLL-UP match plates and match plate work in the stove foundry is not a new development, and the economy resulting from this practice is pretty generally recognized. Many stove manufacturers have devised systems involving the use of match plates best adapted to their shops. All of these methods are designed to reduce the skill required of the molder to the minimum and to increase the percentage of good castings. The Graf-Webb Iron Co., stove manufacturer, Louisville, Ky., has developed and is applying to the work in its foundry a roll-up match plate and hingeless snap flask that embody many novel features of design and construction. The match plate is being applied only to work that is too large to be handled on molding machines and is being used for molding stove bases, doors, crowns, tops and similar work.

The foundry has 55 floors, on 15 of which the roll-up match plate is being used. Of the 55 men employed in the foundry only a few are skilled molders, and a large number of the employes are without previous foundry experience. The output of the floors on which match plates are used is about 60 per cent larger than on the floors not provided with labor-saving appliances. By the use of the match plates the output for the entire shop has been increased 100 pounds of castings per man, per day. The stove castings shown in the foreground, Fig. 4, formerly costing 12½ cents each, are now molded at a cost of 4 cents each, and at the same time the men employed on this class of work are earning more money than is possible under the old hand methods. A number of the men handling the match plates have had only four to six weeks' experience in foundry work.

For molding stove castings of large size this concern has perfected a roll-up match plate, a hingeless snap flask and a skeleton snap clamp. The flask, *2*, Fig. 6, consists of a solid back, *A*, to which is secured two end pieces, *B*, with the outside ends spaced farther apart than the inside ends. The other side piece, *C*, of the flask is removable and is fastened to the end pieces by draw bolts, *E*, and escutcheons, *D*, so arranged that the bolts are inserted in the opening of the locking bars, *F*. The draw bars are malleable cast iron and taper from the point back so that when driven tight the taper makes them fit snugly. The flask can either be used as a snap flask for light work, or as a regular roll-up flask for heavy work. In setting up the work the front part of the flask is placed on the follow board and the back, with the end pieces attached, is placed in position on the board and the locking bars inserted through the openings of the front section. The locking bars are then drawn and when inserted in the side pieces, securely hold the flask together. The cope is locked together in the same way and placed upon the drag after this half of the mold has been rammed. When the mold is finished the draw bolts are drawn and the front part of the flask is removed. The back and end pieces of the flask are then drawn laterally as the angle between them permits of easy movement. No hinges of any kind are used on this flask.

For molds that are too large to carry the entire cope unsupported, metal lugs are cast into the flask sides to receive the ends of the cross bars. Wooden bars are used and the lugs are cast on the flask so that they can be inserted across the flask either lengthwise or crosswise.

The drag and cope of this flask can be hinged together for roll-up work with a hinge, so designed, that a match plate can be used between the joints of the hinge. The roll-up bearings of the match plate are detachable and are made of cast iron with chilled bearings. The match plates are fitted with a seat, *7*,

FIG. 1—FLOORS OF STOVE PLATE MOLDS, SHOWING THE HINGED MATCH PLATE AND CASTING IN THE FOREGROUND

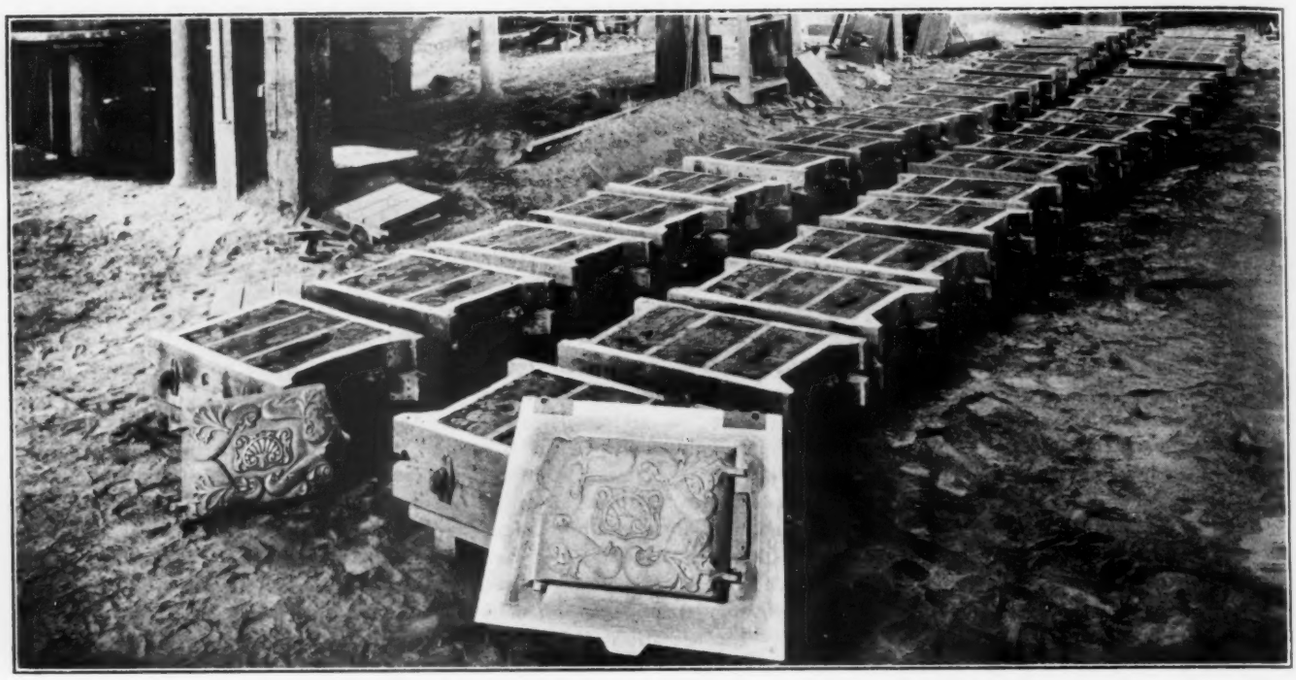


FIG. 2—FLOOR OF MOLDS MADE IN ORDINARY WOODEN FLASKS, EQUIPPED WITH ROLL-UP HINGES

as shown at *5*, Fig. 6, which receives the marginal bearing. In adapting old match plates for roll-up use, marginal seats are cut to receive the hinges, thereby converting the ordinary lift-up match plate into a roll-up plate.

The hinge on the flasks is built up as shown at *4*, Fig. 6, so arranged that a boss, *A*, fits into the match plate between the hinge. When the match plate is removed, the boss fits down into the other side of the hinge, bringing the flask together. The hinged plates used for hinges on the match plates are exact counterparts of each other, except that they are made right and left and the opening for the point of the hinge is longer on one than on the other. This allows any adjustment to be taken up in the hinge itself without causing any spreading between the hinges. The hinges for the flasks are made by two semi-circular hooks whose upper faces are V-shape in cross-section. Integral bosses on the upper faces of the plates, spaced slightly apart, form a bearing for the journal formed by the marginal extension of the hinge plate of the match plate. The marginal, up-turned portions of the hinge are flush on the inside with the outside of the body of the flask. No pins are used for guides on the flask as the bosses cast in the hinge itself seat the match plate and cope accurately when lowered into place. The match plates used are made of aluminum and have bearing surface on the four corners only. The sides of the plate are thinner than the corners. This makes it possible to use a match plate that is not absolutely flat without resulting in crooked castings.

For molding stove castings of this size without the use of a flask, a skeleton clamp is used. This clamp consists of a barred skeleton frame which is placed on the top of the cope so that the ends project slightly beyond the edges of the mold. By means of ears on the top of this skeleton frame, arms, *A*, shown at *5*, Fig. 6, are pinned to it and swing out from the frame of the flask. At the free ends of these arms, extensions are cast integral with them,

FIG. 3—FOUR FLOORS OF STOVE BARREL MOLDS, SHOWING THE METHOD OF CLAMPING THE MOLDS WHEN POURING

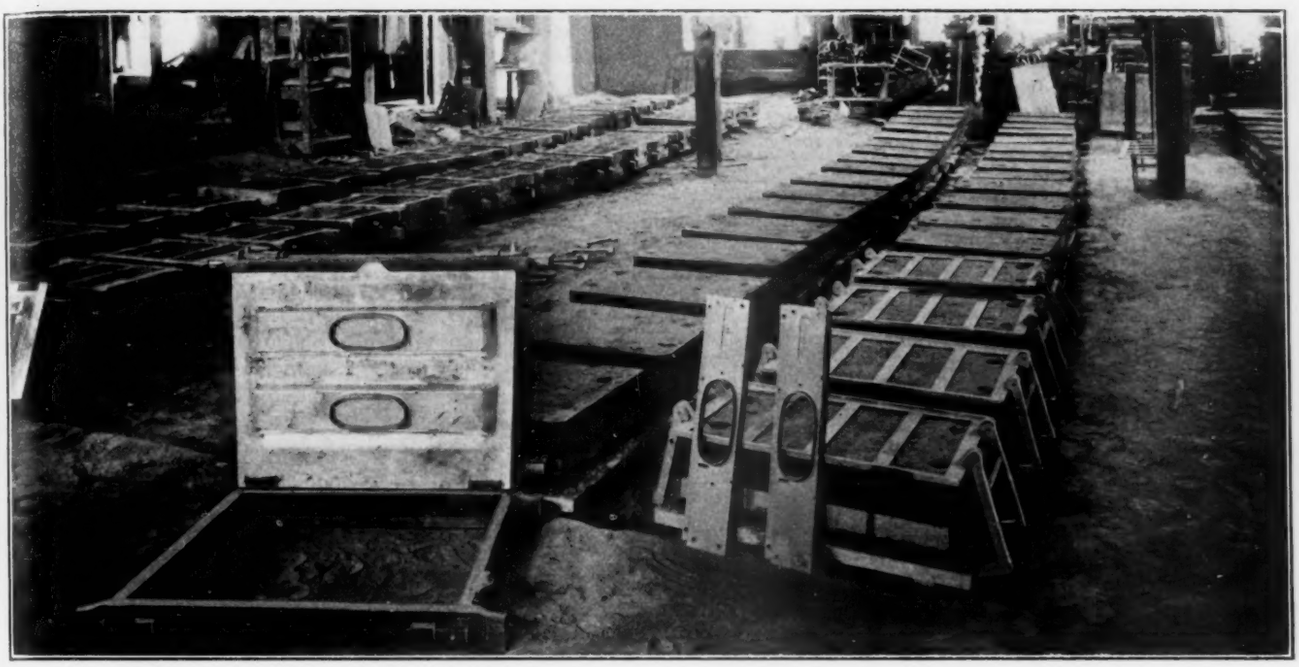


FIG. 4—TWO FLOORS OF LARGE MOLDS MADE WITH ALUMINUM MATCH PLATES IN FLASKS EQUIPPED WITH ROLL-UP HINGES

having an inside angle greater than 90 degrees. The upper inside margins of these extensions are serrated. In using this clamp it is placed over the mold and the arms are swung under the bottom of the follow board and are wedged to hold them firmly in place. For the molds on one floor comprising a day's work, five or six of these clamps are used, being removed as soon as the molds are poured. In Fig. 1 is shown the method of applying these clamps to molds made by the roll-up match plates.

In Fig. 3 is shown the method of molding high stove barrels without flasks, using sand bands at the joint of the cope and drag and a lift-up match plate and hinged snap flask. In this view, *W* is the match plate, *B* the drag, and *C* the hinged cope flask, showing the sand band and front of the flask removed. For pouring these molds, a skeleton clamp with very much longer arms and skeleton frame is used. For a floor of these molds, 10 snap clamps are used and they are removed from the molds as soon as poured and placed on those that are still to be cast. By the use of this clamp in place of the ordinary, single clamp, the pressure is distributed over the top of the cope and particularly on the edges in place of the center. In contrast with the driven clamp a uniform pressure can be applied and it is impossible to drive the clamp on so hard as to injure the mold, as is often done wth the ordinary clamp.

Figs. 1, 2, 3 and 5 show various stove plate castings, the match plates used, the arrangement of the skeleton snap clamps on the molds and the arrangement of the day's work on the molding floors. The molds are put up in two double rows, starting at the center aisle of the foundry floor and working back toward the outside wall to the sand heaps where the molding is done.

FIG. 5—FLOOR OF 64 MOLDS OF OVEN DOOR FRAMES WHICH CONSTITUTE A DAY'S WORK FOR ONE MAN USING HINGED MATCH PLATES

Melting Steel Scrap

By N. W. Shed

Question:—We would like to melt semi-steel in our cupola, using coke as fuel. Our pig iron is of the following analysis: Silicon, 1.10 to 1.30 per cent; sulphur, 0.02 to 0.04 per cent; phosphorus, 0.85 to 0.95 per cent, and manganese, 0.90 to 1.00 per cent. Our steel scrap consists of small ends of bars, punchings, etc., and is of a light character. Some of this scrap, however, is high in carbon, approximately 0.40 to 0.50 per cent. Several of our castings are light, averaging from 2½ to 5 pounds each, and are chilled on one edge with a chill, about one inch wide and 4 to 6 inches long. These castings are to be hard, strong and tough, but if the iron is too hard, the castings will be brittle and will chip in the tumbling mills. We have been fairly successful in using this pig iron in our mixtures, made up of practically one-half pig and one-half scrap, mostly stove plate, with about 10 per cent steel. We are troubled with excessive slag and the cupola lining in the melting zone burns out in a few days. Our iron, however, is always hot. We have tried charging the steel scrap on the bed first, with the pig metal next, and last the stove plate, and before the metal will melt the slag will choke up the tap hole.

Answer:—The steel scrap used in this mixture is burnt by the blast before it is melted. By throwing a few pounds of ferro-manganese on the scrap and by operating at a lower blast pressure, little trouble should be experienced in melting this stock. The stove plate you use is also very light and has a tendency to oxidize before it is melted. By using heavy scrap, both iron and steel, you will experience little difficulty. It would be a good plan to cover the steel scrap with coke before adding the pig iron and stove plate. You might try running about 60 per cent pig iron with a lower percentage of stove plate scrap and charge 60 pounds of limestone to every ton of iron. By using an increased amount of coke and by reducing the blast pressure, the tendency to burn the stock will be overcome. The excessive cinder is caused by the iron being reduced to oxide, thereby increasing the amount of slag.

The Equalize Foundry Co., Chicago, incorporated with a capital of $30,000, will engage in the manufacture of hardware specialties.

Cracking of Sprocket Wheels

By W. J. Keep

Question:—A large number of small sprocket wheels which we manufacture are broken in the tumbling mills. The metal thickness of each wheel varies from ⅜ to 1 inch. We would like to know whether we cannot re-design this wheel without increasing its weight, so that it will not break in cooling. The casting usually fractures in the rim. We would like to know whether by cutting out some of the spokes and making the remainder of the spokes heavier our difficulties would be overcome?

Answer:—The angle between each of the teeth of these wheels is too sharp and I would suggest rounding these corners, which undoubtedly would result in the elimination of the breakage of your casting. Change your method of gating so that all parts of the wheel will uniformly solidify. If necessary, reduce the weight of the heavy parts so that no section of the wheel will cool faster than another.

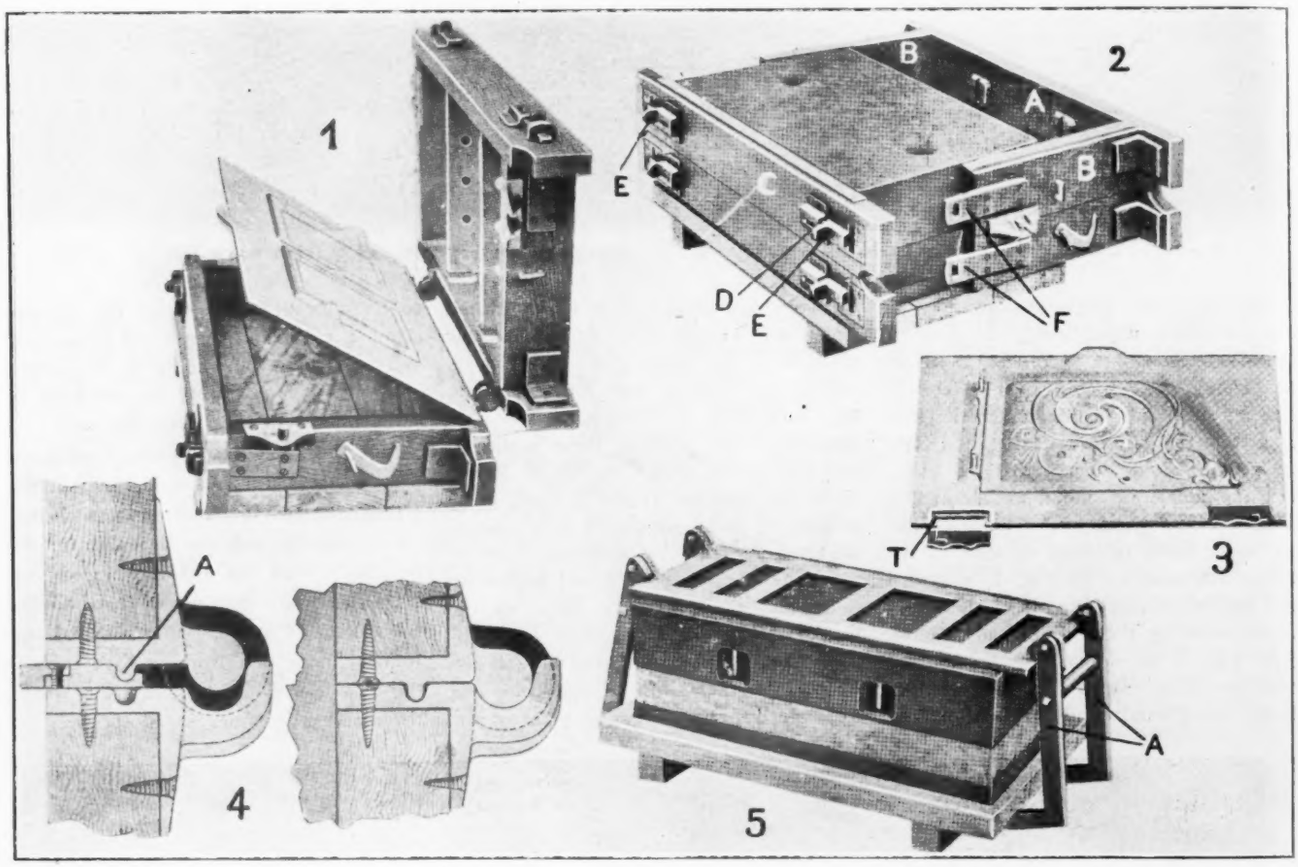


FIG. 6—THE ROLL-UP FLASK, HINGELESS SNAP FLASK, ROLL-UP HINGE AND SKELETON CLAMP

1—ROLL-UP FLASK, WITH MATCH PLATE
2—HINGELESS SNAP FLASK PARTIALLY WITHDRAWN FROM THE MOLD
3—MATCH PLATE WITH DETACHABLE BEARING
4—SECTIONAL VIEWS OF ROLL-UP HINGE WITH AND WITHOUT MATCH PLATE
5—MOLD CLAMPED WITH SKELETON WEIGHT

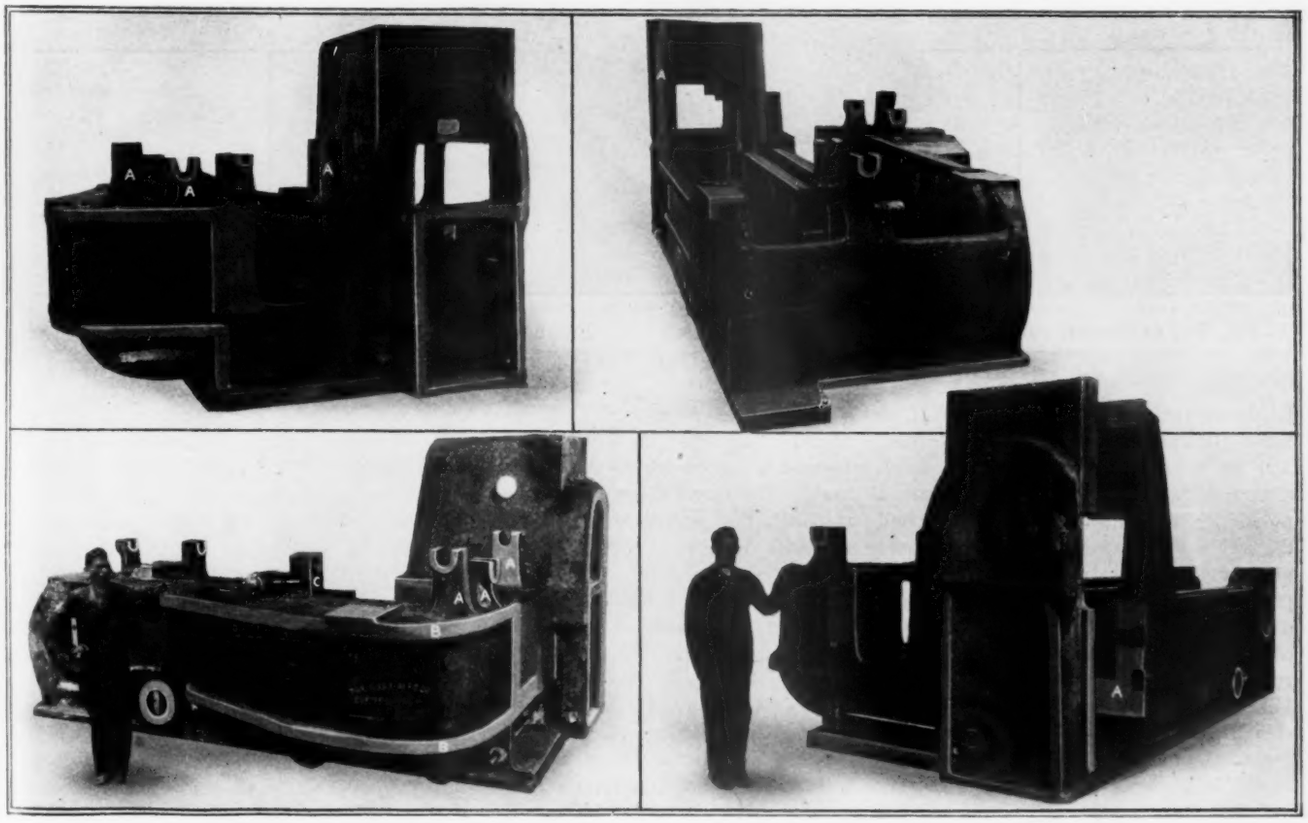
PATTERN FOR FORGING MACHINE FRAME

Description of the construction of this large pattern---Numerous loose parts of the pattern---The core boxes

By Jabez Nall

MANY novel and interesting features of patternmaking were involved in the construction of the pattern for the 5-inch universal forging machine frame casting, shown in Figs. 1, 2, 3 and 4. There are usually several different ways of doing the same job, and while all of them may be practical, in the sense that they are not impossible, to select the most expedient requires a knowledge of the advantages and disadvantages of all. The patternmaker should constantly keep in mind that the pattern is merely a tool for the use of the molder and it should be made as simple as possible. To attain this end may entail additional cost in the pattern shop, but if the results justify this expense, it should be assumed, as a saving in the cost of molding can be effected in the foundry. For example, the part of the mold above and between the lines, *X*, Fig. 11, can be made by the use of a drawback at this point, the pattern being inverted in the mold from the position shown. This method was followed by the molder when making skin-dried molds for a cast iron frame. It also proved to be the cheapest method of making the pattern and it saved the cost of adding the prints and making the core box. However, an anchor frame casting was required to lift the sand away and several partings were necessary, which resulted in a break in ramming the mold and entailed considerable risk in handling this loose part of the mold. The method illustrated was adopted, which resulted in the saving of considerable time, although it required the making of several cores.

While the best method of molding this casting was being considered, the problem of forming the lugs, *AA*, for the tie rods, Figs. 1 and 2, had to be solved. It will be noted that they overhang the main body of the casting and are from four to five times as high as the thickness of the rib, upon which they partly rest. While it would be possible to divide them into a number of parts and to draw them in through the space left after the withdrawal of the rib, this method would hardly be considered practical, owing to the difficulty that would be encountered in holding them true with the pattern inverted in the mold. For this reason, some kind of a parting at this point became an absolute necessity, but to place the whole pattern in a flask and to check off the main part of the mold would have required considerable extra equipment, such as flasks, facilities for handling and ovens of large capacity, as the casting weighed, in the rough, 65,000 pounds. To avoid all drawbacks or partings, another method had to be adopted. It was, of course, possible to core out the parts between the ribs, *B*, Fig. 2, but this would necessitate increasing the length of the entire pattern to carry out this print a sufficient length to balance the core. The use of cores without prints would involve less work,



VIEWS OF A LARGE, CAST STEEL FRAME FOR A UNIVERSAL FORGING MACHINE

FIG. 1
FIG. 2
FIG. 3
FIG. 4

this part of the mold being made in a core box. When beginning to mold, this core is set when the molder forms the seat for his pattern, a part of which is duplicated to allow it to enter the core and to thus obtain the correct position.

A shrinkage allowance of 1/10 inch was provided and this proved sufficient as the casting machined up to size, with the exception of one facing, *A*, Fig. 4, which was 3/32 inch too small. It is evident that the long wall from *A* to the end of the casting, without the resistance from cores, shrunk more than the allowance provided and this could have been prevented, to some extent, by casting tie bars across this space or by providing for an extra allowance for the metal would contract, any variations in the length could be adjusted at these points.

After having provided for the shrinkage and finish, a working layout, full size, was made. A composite drawing of the two sections, shown in Figs. 11 and 12, was made on a board which was carefully leveled. The lines of the core print were added and the conflicting lines were drawn in different colors. A measuring pole was used, which had on its face all of the principal dimensions for the longitudinal section of the pattern, the centers of the bosses and the position of the inside framework. This pole was coated with shellac to preserve the lines and figures while it was in use.

proper place to build large patterns is on the ground floor and on a permanent level base, designed for this purpose. In Fig. 5 is shown the framework for the larger section of the pattern and this was subsequently braced similar to the framework bracing, Fig. 6. In Fig. 8 is clearly shown the direction of the grain of the lumber used in the construction of the pattern. After completing the larger pattern section, the framework of the top was set in position with the end frames only abutting the wall of the other section, the intermediate framework being separated 1/2 inch. When the framework was enclosed, the boards outlining the pattern abutted against east other. The 1/2 inch allowance between the intermediate

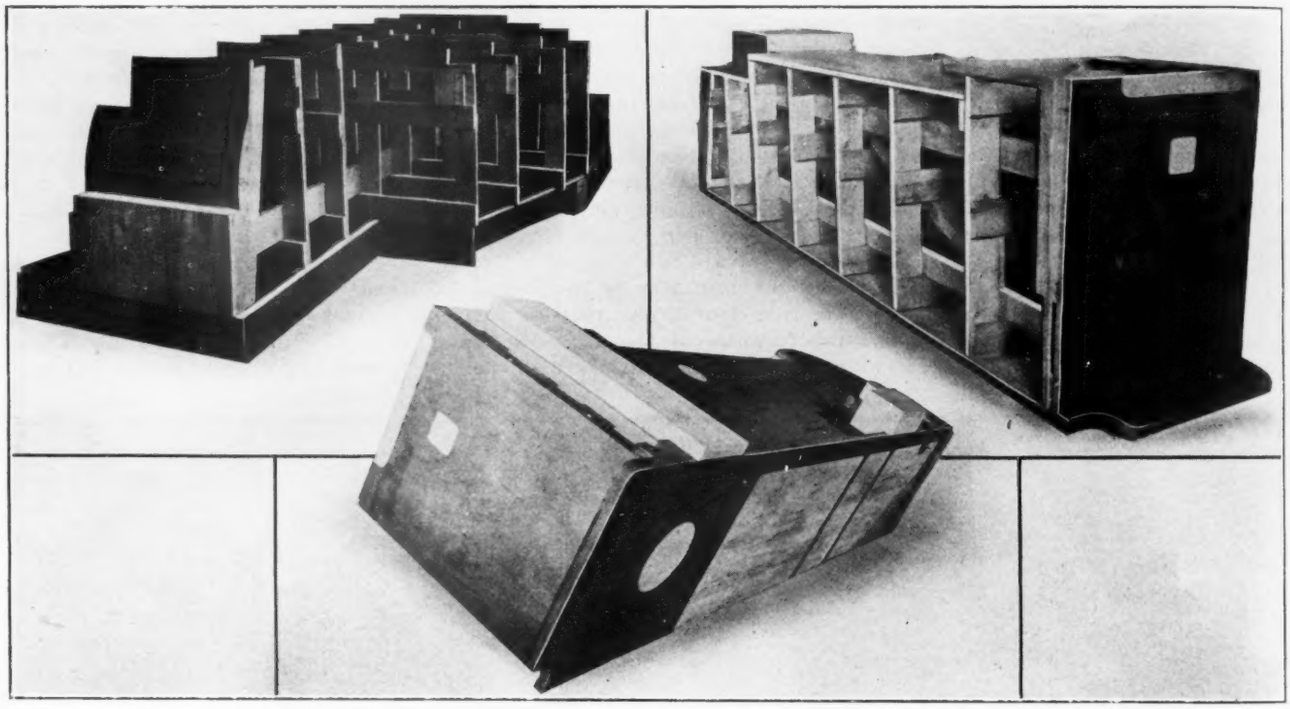


FIG. 5—FRAMEWORK FOR THE LARGE SECTION OF THE PATTERN FIG. 6—PATTERN FRAMEWORK, SHOWING METHOD OF BRACING
FIG. 7—A VIEW OF ONE PART OF THE PATTERN

finish at this point. At *a*, Fig. 12, a finish allowance of 3/8 inch was provided, and at *b*, Figs. 11 and 12, the finish allowance was 1/2 inch, as there was a possibility that the clay placed around the vents underneath these cores would prevent the cores from setting in place properly, which would reduce the amount of finish allowance. A finish allowance of 1/2 inch was also provided on the facings for the vertical slides, *c*, Fig. 11. It was believed that the shrinkage at these points would be large and, as previously stated, exceeded expectations. A finish allowance of 5/8 inch or 1 1/4 inches in the diameter was allowed in the openings for the crank and pinion shafts. This proved to be ample, but as there was some doubt as to the amount

The inside framework was next assembled on the layout board, which formed a jig on which the frames were built. For convenience in handling and shipping, the pattern was divided longitudinally into two parts, as shown in Figs. 8 and 9. While the frames were being assembled, a level base, *A*, Fig. 8, made of 2 x 10-inch pine planking, was constructed, upon which the pattern was built. The base is one of the essential features required in the construction of this pattern and was carefully blocked and leveled. Nevertheless, some trouble was experienced, apparently from the sagging of the floor underneath the weight of the pattern when it reached the stage of completion, as shown in Fig. 8. Thus, it would seem that the frames made it an easy matter to correct the pattern in the event of its warping at some future time. Another view of the pattern is shown in Fig. 9, with some of the loose parts in position.

While forming the lugs, *AA*, Fig. 1, the fact that the pattern was to be bedded in the floor had to be kept in mind. As this part of the pattern formed the under-side of the mold, the lugs, with the exception of the small loose parts necessary for draft, were made in one piece. An offset, *BB*, Fig. 9, was provided in each section of the pattern to receive the lug block, *B*, Fig. 8. In this illustration, the lugs are shown in place and the molder merely tucks the sand around this part of the pattern carry-

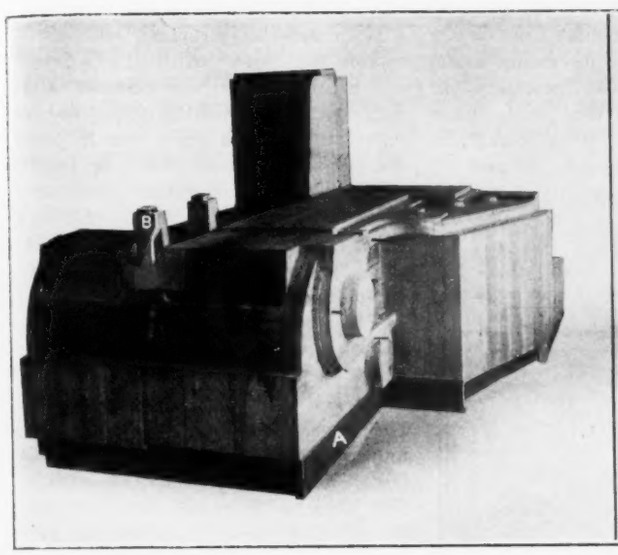


FIG. 8—THE PATTERN MOUNTED ON A BASE, *A*

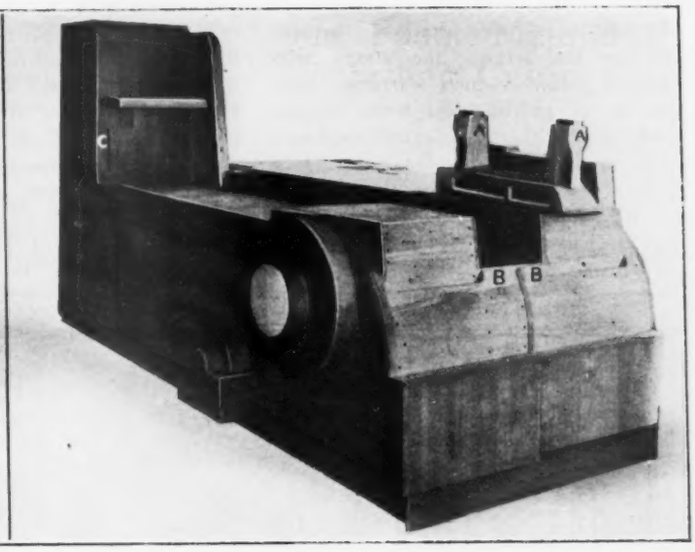


FIG. 9—ANOTHER VIEW OF THE PATTERN

ing the lugs, to keep it in place and completes the ramming of the mold after the body of the pattern has been withdrawn from the sand. As the lug, *C*, Fig. 2, was inaccessible when bedding the pattern, a plain block print with a fair amount of taper was made sufficiently large to allow for the sand to enclose the lug. This was made loose, but was adjusted to the pattern with brads when molding, and when lowered down with the pattern, its location in the bed was outlined, thus permitting the molder to dig out the sand at this point and to bed the lug in position. The print remained in the mold after the pattern was withdrawn and a core was used to form a lug which was made in core box *18*.

The rib, which is fitted at *C*, Fig. 9, and which overhangs the main part of the pattern, as shown at *A*, Fig. 3, was of such form and in such a position that it was impossible to withdraw it after the pattern had been removed. A core print was attached to the back of this rib, as shown at *2*, Fig. 10. Another difficulty was experienced, however, as a portion of the print still overhung, which made it impossible to set the core in one piece. Therefore, when making this core, the core box was made full depth and the coremaker was instructed to make the two cores in one box and by parting them and making the top half wedge shape, the cores were easily set in position and were accurately located when they reached the bottom of the mold. The loose parts of the pattern are shown in Fig. 10. Lifting straps, made of ½ x 3-inch steel, were adjusted to the main section of the pattern. These straps, which were about 28 inches long and were screwed to the inside of the outside boards, were hooked at the ends. To prevent the hooked ends of the straps from pulling out, straddle pieces were screwed and glued in position over the straps at their bottom ends. This method of attaching these straps should have been sufficient to secure them and to prevent them from being pulled out on a straight lift. However, when the first casting was made, one strap worked loose, and when withdrawing the pattern from the sand for the third casting, another strap was pulled out. Upon investigation it was found that a straight lift was not being obtained on the pattern, as stretchers were not placed between the chains which were hooked into the end strap and formed a triangle with the top of the pattern as the base, and the crane hook as the apex. The chains pulled the straps toward each other, shearing off the screws and pulling out the straps. To prevent a recurrence of this difficulty, which could have been avoided with reasonable care, all of the straps were removed and new straps, about 8 inches longer than

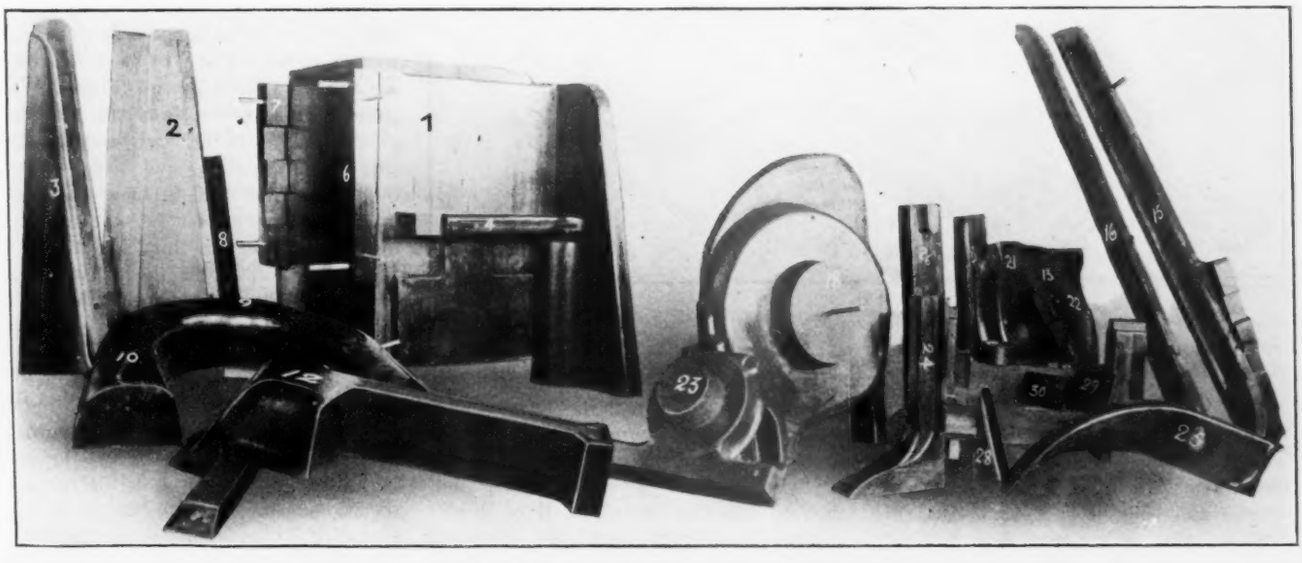
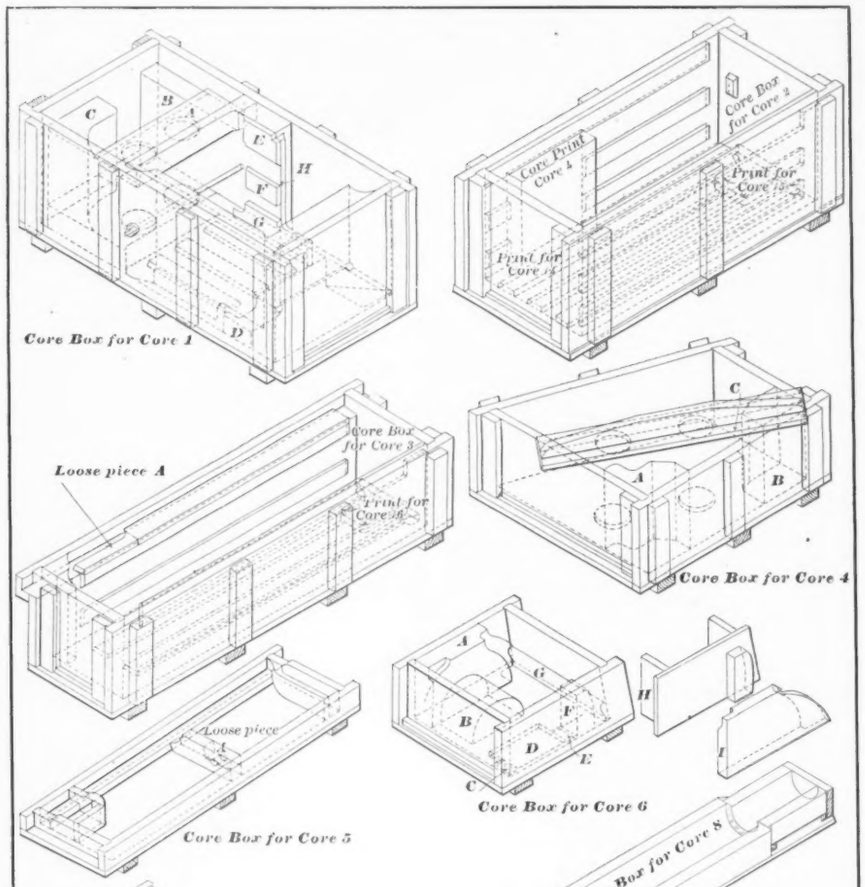


FIG. 10—LOOSE PARTS OF THE PATTERN

the first ones, were attached. In addition to the screws, the straps were fastened with ½-inch carriage bolts. The heads of the bolts were countersunk and washers of extra size were used to increase the bearing surface. This effectively overcame the previous difficulty, and this experience points out the necessity of amply securing the lifting straps. The core boxes is held together with bolts. Core box *3* has a small section of its facing loose, which construction was necessary to form tool clearance at this point. Core box *4*, in which the wing core was made, has loose parts, *A*, *B* and *C*, which form a cross bar to carry the bosses at the top of the box. The top rib is made of hard wood and was intended not only to keep this bar


Core Box for Core 1
Core Box for Core 2
Core Print Core 4
Print for Core 3
Print for Core 14
Loose piece A
Core Box for Core 3
Print for Core 16
Core Box for Core 4
Loose piece
Core Box for Core 5
Core Box for Core 6
Core Box for Core 8
Core Box for Core 7
Core Box for Cores 9 and 10
Core Box for Core 11
Core Box for Core 12
Core Box for Core 13
Core Box for Core 14
Core Box for Core 15
Core 16
The Foundry

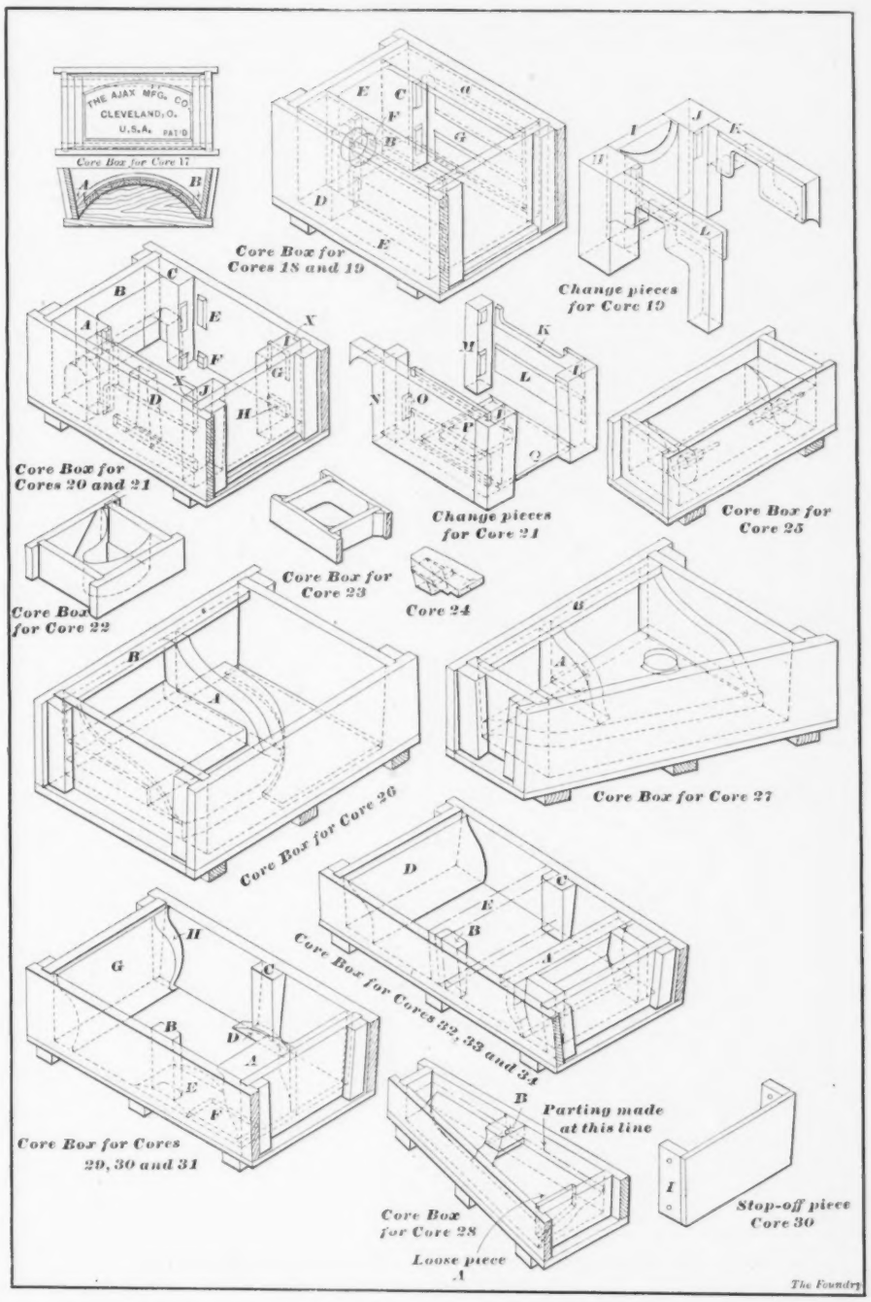
CORE BOXES FOR THE CORES FOR THE FORGING MACHINE FRAME MOLD

for the cores for this casting, which are shown in the accompanying illustrations, are numbered from 1 to 34. Core box *2* contains only one loose part, which is a core print for core *4* and stop-off core *14*. This core box, as well as the core box for core *3*, are similar in construction, all facings being attached to the box, which straight, but to provide the coremaker a solid base, on which to rap the box when making the core. When forming the bosses, it is the practice to first fill the core box level with the top and then to add this cross bar, thus obtaining the location of the bosses. A small amount of sand is removed and the boss is then forced into position. Core box *5* is of solid construction, with the exception of loose part, *A*. The rib is cut in the center and contains a 1½-inch opening, which permits the coremaker to lay in a heavy rod to connect the two divisions of this core together, the only other connection being at the top of the rib. This rod is cast in the metal, being later cut off at either end. Core box *6* requires little explanation, all parts in the box being loose and are located by dowels where necessary. Two cores are made from this box, which accounts for the loose parts. After one core is made, the loose pieces are interchanged for the other core, thus providing two opposite cores. Core box *7* is similar in construction to core box *6*, and likewise requires change pieces. Core boxes *8*, *9*, *10* and *11* are self-explanatory, and the cores made in *9* and *10* are of different lengths, which is accomplished by the use of the stop-off piece shown. The core made in core box *12* is necessary to permit of placing the core made in core box *8* in the mold. Its position and form can be noted from the core print and other parts of the boss, shown in Fig. 9. The core made in core box *13* forms the curve at one end of the casting and avoids a drawback at this point. This box was made sufficiently long to provide for future changes, one core being made full length with pieces *A* and *B* removed. The second core, as shown at *A*, is a shaft bracket and forms the seat for the motor bracket, the machine being direct-geared to a motor. A stop-off piece, *B*, is provided to give the correct length. The core made in core box *14* is a stop-off core, which makes up the difference between the depth of the core made in core box *4* and the core print for this core shown in core box *3*. The core made in core box *15* and core *16* are similar, but of different dimensions.

The name plate core is made in core box *17*, which is shown in plan and side elevation. Pieces *A* and *B* are left loose, to insure sharp corners. The panel for the letters was cut from lagging. The core is first made to the top of the print line and swept off, and the top of the box is filled with heap sand to form a seat on which to dry the core. The core made in boxes *18*, *19*, *20* and *21* form the openings for the vertical press or squeezer section of the casting and are used in the mold in the order given. Parts *A* and *B* of the core made in core box *18* are of the same thickness as the core print or loose piece, *1*, Fig. 10. These parts with the top edge of *E*, form the print section of the core, while below these are the blocks *E* and *G*, which give the thickness of the metal at the sides. Only the outlines of the parts fitting in the box are shown, which make them

appear of solid construction, whereas they are faced with one-inch stock, being backed out according to the thickness or shape required. The change pieces for core box *19* are shown assembled, as they fit in the box, the frame of core box *19* only being used. Core boxes *20* and *21* are similarly arranged. The piece, *D*, is a core print for the core *24*, which forms an opening through the front of the casting at an angle of 30 degrees, through which the punchings are dropped. A tail print down to the joint of the core is necessary to insure the placing of this core in the mold without being broken. Parts *I* and *J* of core boxes *20* and *21* are used in both cores and form the guide print for the cores. They are backed by strips, *X*, which equal in thickness the amount of taper allowed in one-half the length of the print. Thus, the dimension at the bottom of this part of core *20* equals the corresponding dimension at the top of core *21*. In this core is a print for the core made in core box *23*, which cuts through the top of the mold and the core resting on this prevents this line of cores from raising. The core made in core box *25* was placed in one end of the mold and has two prints which are held in position by loose dowels. These are for the bearing for the treadle shaft. The cores made in core boxes *26* and *27* are known as anchor cores, inasmuch as they replace the anchor or drawback previously referred to. In core box *28* the facing, *A*, is left loose, while part of the rib, *B*, is made removable for convenience in sweeping off the box when dividing the core. Lightning cores are made in the core boxes for cores *29*, *30* and *31*. The loose parts are provided for core *31*, *E* and *D* being required to finish out the diameter of the crank shaft bosses; *F* is a core print for core *22*, which reduces the weight of the rear of the center bearing; pieces *B* and *C* provide for additional metal to carry a sufficient feeding head at the rear end of the casting; *G* forms the metal surrounding the chambered core for the pinion shaft, core *8*; *A* is a separate piece for the end, which is provided for the purpose of changing the box for core *30*, *G* being used at the opposite end of the box, the core being made the whole length by using stop-off piece, *I*, which is located by dowel pins. For core *29* this stop-off piece is also used, being located at the end of the box, the battens giving the required length. The core box for cores *32*, *33* and *34* is similar in construction to the box for cores *29*, *30* and *31*. This box is made of sufficient length for cores *32* and *33*, which are plain and are separated by a rib, as shown by the broken lines. Piece *D* is used for making core *33*, in the position indicated. This illustration shows the box arranged for making core *34*, piece *A* being backed out sufficiently to provide the proper length; pieces *B* and *C* provide metal for a feeding head.

The Sand Mixing Machine Co., New York City, announces the appointment of two additional sales representatives. Wm. A. Heartt, formerly associated with the Interstate-McMyler Co., will represent this concern in Indiana, Illinois, Michigan and Wisconsin, and Hutton H. Haley, formerly western representative of the J. D. Smith Foundry Supply Co., will represent the Sand Mixing Machine Co. in eastern Ohio, Pennsylvania and western New York.


THE AJAX MFG. CO.
CLEVELAND, O.
U.S.A. PAT'D
Core Box for Core 17
Core Box for Cores 18 and 19
Change pieces for Core 19
Core Box for Cores 20 and 21
Change pieces for Core 21
Core Box for Core 25
Core Box for Core 22
Core Box for Core 23
Core 24
Core Box for Core 26
Core Box for Core 27
Core Box for Cores 32, 33 and 34
Core Box for Cores 29, 30 and 31
Parting made at this line
Core Box for Core 28
Loose piece
Stop-off piece Core 30
The Foundry

CORE BOXES FOR THE CORES FOR THE FORGING MACHINE FRAME MOLD

The Pound Method of Selling Castings

By Edward Kirk

IT HAS long been the practice of foundrymen to dispose of their product by weight. This method has its advantages and disadvantages. It enables the founder to receive payment for every pound of metal in his castings and, furthermore, enables him to determine at the end of each month or year, the exact weight of castings produced, cost per pound of iron, etc. However, this method of selling by weight also subjects the foundryman to demands from his customer for reductions in the price of

castings, when the cost of pig iron or non-ferrous metals declines, but on the other hand, when there is an advance in the cost of raw material it is difficult to increase the selling price. Purchasers of castings watch the iron and metal markets closely and as soon as prices decline they insist upon a proportionate reduction in the price of castings.

There is no more reason why the price of castings should be based upon the price of pig iron or metals than that the price of a piece of furniture should be based upon the cost of the lumber consumed in its manufacture. A purchaser of furniture never objects to the price, contending that the price of lumber has declined. It is not the value of the raw material consumed in the production of an article that determines its value, but rather the cost of the skilled labor required in its manufacture that determines its value. The cost for labor in producing a complicated, cored casting may be three or four times greater than that of a plain section poured from the same ladle of iron and it is, therefore, absurd to base the price of castings upon the price of the raw material.

The system of basing the cost of castings upon their weight was probably adopted before means were devised of determining the weight of a casting from a wooden pattern. This difficulty, however, has long since been overcome. I have recently come in contact with a number of foundrymen who have adopted the piece price system and in one shop a small decorative arrow head is being cast which is sold at a price of 25 cents and usually nets the founder 15 cents per pound. In another foundry, automobile cylinders are sold by the piece which net the founder 30 cents per pound and recently, while in a Baltimore foundry I was shown a propeller wheel sold on a piece price basis which netted the founder 40 cents per pound. If the purchaser of these castings had been asked the pound price, knowing the cost of pig iron per ton, he certainly would have objected, nevertheless, the price asked for the completed article seemed entirely satisfactory. However, the piece price cannot be adopted by foundrymen, except by those who are engaged in the manufacture of specialties, so long as their competitors are selling on the pound basis. Recently, I met a foundryman in a Massachusets town who had an order for two small propeller wheels weighing 3½ pounds each, which were to be molded from a brass wheel as a pattern. The price charged for these wheels was 5 cents per pound or 35 cents for the two castings. This was not sufficient to pay for the core box and for placing the core print on the pattern and when the founder's attention was called to this apparent loss in the cost of producing these castings, he replied that he was unable to charge a higher price as light castings were selling on a basis of 5 cents per pound in that locality.

While the piece price would undoubtedly increase the cost of castings, in may cases it would prove advantageous to consumers, especially those using the heavier classes of machine sections. It would probably result in the production of a better grade of castings and, in addition, there would not be the tendency among foundrymen to increase the weight of these heavier sections so as to increase the cost of the casting. The consumer is thus required to pay for the increased weight and the additional cost of machining. As a result, the purchaser of castings is never certain what the casting will cost until it is delivered and the expense of finishing is always an unknown factor until the work has been completed. With a piece price system the increased weight of castings as a result of soft ramming, improper pouring, etc., which produce swells and strains, would result in a loss to the founder and it would be to his interest to keep down the weight of the various sections and to produce more perfect castings.

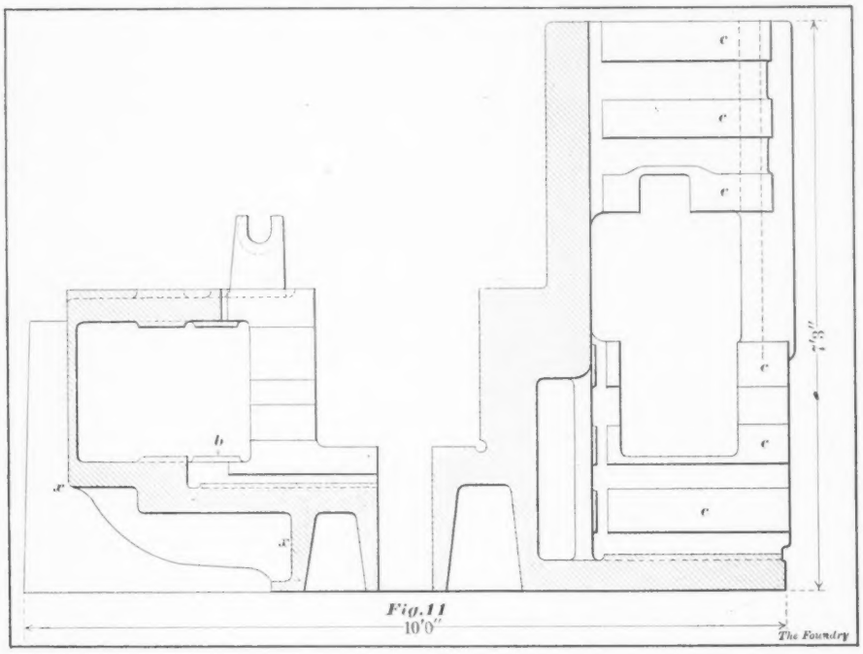


Fig. 11

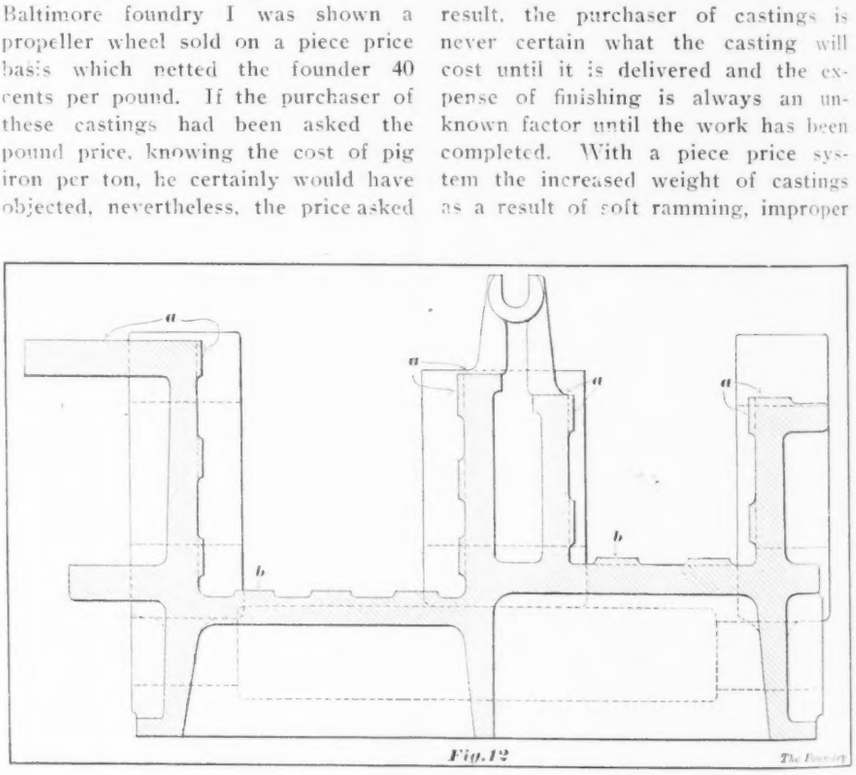


Fig. 12

HISTORY OF THE FOUNDRY SAND BLAST

Development of this casting cleaning device--Descriptions of the various types of these machines---Foreign practice

By J. F. Springer

IN 1870 a patent was obtained by B. C. Tilghman, Philadelphia, covering the use of sand as a projectile for the cutting, grinding, dressing and engraving of stone, metal, glass, or any other hard substance. This claim included all mechanical devices capable of imparting the necessary velocity to the sand, whether steam, air, gas, water or centrifugal force. This was the beginning of the sand blast, at first largely used for etching, frosting and decorating glass, but later finding an extensive field of usefulness for cleaning castings in the foundry.

Primitive Machine.

In the primitive machine of 40 years ago, the sand was driven by steam, as shown in Fig. 9. The supply of sand was kept in the reservoir, *W*, below which is the hopper, *A*, connected by a flexible hose, *B*, to the sand tube, *C*. Enveloping this tube is the steam tube, *D*, the opening between them being closed by the gland, *E*. Both tubes end on the left at the same point, the outer tube being taperingly reduced to form a nozzle, the opening of which is very small and surrounds the inner tube, which is of the same bore throughout. The tube, *I*, is rigidly connected to the nozzle by the sleeve shown, and must be in perfect alignment with the other tubes. A jointed steam tube, *O*, is connected to the chamber, *G*, which has stuffing boxes at *H*. Steam is admitted to the tube, *D*, through the openings *FF*, and during operation escapes through the annular opening, *M*, and expanding into the tube, *I*, sets in motion a current of air, passing from *A*, through *B*, and out through the sand tube, *C*, into the tube, *I*, which brings the sand into position to receive the impulse of the high velocity of the steam rushing through the nozzle, *M*.

In 1899 an apparatus was patented in England by I. E. Mathewson, in which a mixture of sand and water is projected by either steam or compressed air. Fig. 10 is a section of the apparatus, which consists of a hopper, *B*, pressure regulating chamber, *D*, and a funnel, *G*, which are enveloped by the compression chamber *F*. The mixed sand and water in the hopper, *B*, passes through a valve opening downwards into *D*, and then through another valve into the funnel, *G*. The blast is admitted into *F* through pipe, *OO*, which has a branch, *P*, for the occasional agitation of the material at the mouth of the funnel, *G*. The chamber, *D*, is a lock similar to that used in pneumatic caisson work, and can be connected either with the outer air or with the compression chamber, *F*, by means of the three-way cock, *R*.

To permit the sand and water to flow into the chamber, *D*, the cock, *R*, is turned to connect it with the outer air, which permits the pressure to escape, so that the valve, *C*, is pressed down by the weight of the sand in the hopper, *B*. Upon closing this connection and effecting another between *D* and *F*, the valve, *E*, will open, and valve, *C*, is closed by the pressure. The mud then drops by gravity into the funnel, from which the hand valve, *M*, affords a means of exit under the driving impulse of the compressed air or steam in the chamber, *F*, from which it is conducted to the work.

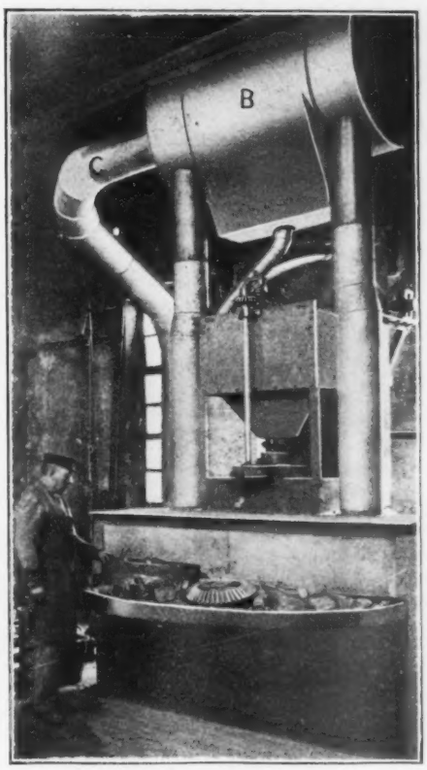


FIG. 1—SAND BLAST EQUIPPED WITH A ROTATING TABLE. THE CENTRIFUGAL DUST SEPARATOR IS ALSO SHOWN

This particular type of blast, using wet sand, is quite effective in sharpening files. It might be thought difficult to cut hardened steel with sand, but it is the velocity with which the little projectiles are driven which makes it possible. Tilghman stated that it is possible to cut carborundum with quartz sand and that quartz might be cut with grains of lead.

Sand Projected by Air.

Another sand blast invented by Mathewson is shown in Fig. 8; *A* is the hopper, which is fitted half way into the funnel, *C*. This has a tubular neck provided with a valve, *B*, and is connected to the horizontal tube, *F*, at a right angle. When the valve, *B*, is opened and steam admitted at *D*, a stream of sand and air is sucked down in front of the nozzle, *H*, and is projected forward by the steam jet and issues from the end of the horizontal tube at *K*. Should it be desirable to withdraw the steam, this can be done by means of the aspirator, *E*.

Fig. 13 shows a simple machine which operates by the formation of a vacuum; *S* is the sand receptacle, from which the sand is sucked up through tube, *B*, and projected against the work at *E*. The large chamber, *D*, is provided with pulleys, over which a cord or chain passes, connected at one end to the lever, *G*, and the other is fastened to the hollow body or piston, *A*, which is flexibly connected at its upper edge to the chamber, *D*. The piston can thus be raised or lowered without admitting air to the chamber, and when it is raised by depressing the lever, *G*, a partial vacuum is created in *D*. The valve, *H*, then opens and a suction is created which causes the sand to be projected against the work.

A German device is shown sectionally in Fig. 11. The cylindrical chamber is divided into four compartments by horizontal partitions. The dry sand is placed in the top compartment, *B*, and passes through the screen to the lower conical part, in which is a valve, *C*, regulated

by the adjustable tension of the spring above, controlling in part the admission of the sand into the next lower compartment, from which it is permitted to flow through the valve, *D*, into the third compartment, and then passes into the ejection tube, *G*, through the cock, *F*, which is controlled by the key, *N*. Compressed air enters through the four-way cock, *K*, and the compartment, *H*, is always under pressure. By a proper manipulation of *K*, the pressure above and below the valve, *C*, can be equalized, permitting the sand to pass into the second chamber, and by further turning *K*, admitting compressed air, the pressure above and below the valve, *D*, is equalized and sand passes into the third compartment, and into the discharge tube, *G*. The pressure in the third compartment is at least equal to that of the lower chamber, so that the sand passes readily into *G*, where it finds an expanding current of air which drives the sand along and thus forms the blast. The advantage of this type of apparatus is that it is capable of continuous operation, because the third chamber is always under pressure and the flow of sand from it is always possible.

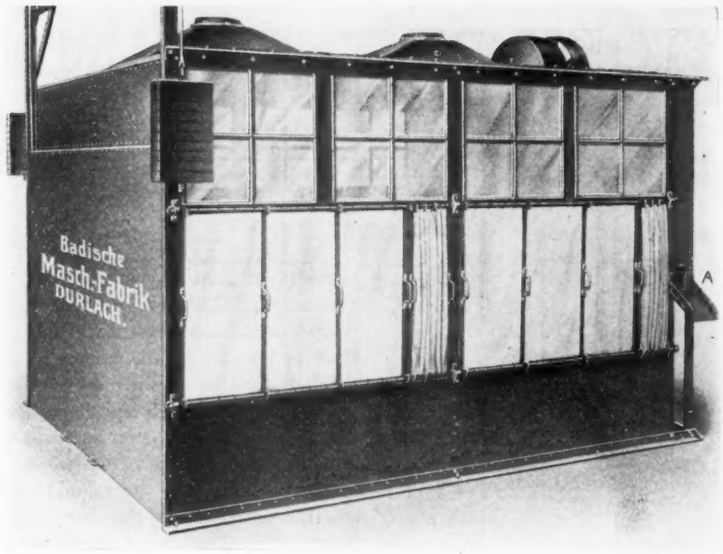


FIG. 3—SAND BLAST HOUSE. THE OPERATOR IS STATIONED OUTSIDE AND IS PROTECTED FROM THE SAND

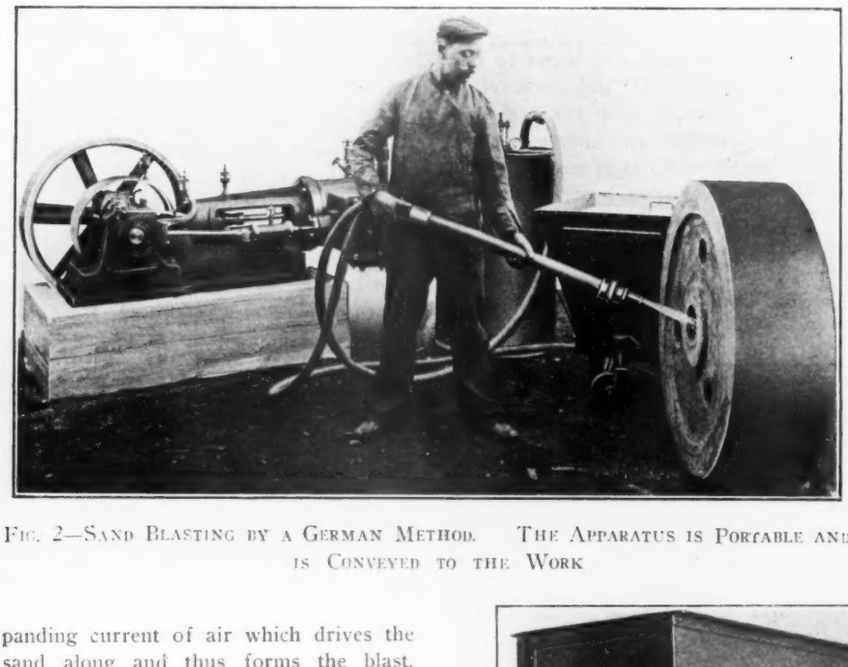


FIG. 2—SAND BLASTING BY A GERMAN METHOD. THE APPARATUS IS PORTABLE AND IS CONVEYED TO THE WORK

work. When the supply of sand in the hopper is exhausted, it is replenished by turning off the compressed air and exhausting the lower chamber. This removes the pressure from the central valve and allows sand to be admitted to the hopper.

A German process which is claiming attention does not permit the sand and air to mingle until they are near the point of exit. This possesses the advantage of confining the wearing surfaces to the immediate vicinity of the nozzle.

The next problem is the manner of applying the sand blast to the work. In Fig. 2 is shown an easy method of sand-blasting castings. Here the workman handles the nozzle much the same as a garden hose and it will be noted that the nozzle is supplied by two tubes,

Another device of Mathewson's, which possesses the merit of simplicity, is shown in section in Fig. 12. In this the receptacle is divided into two parts between which there is communication by means of a valve. The upper chamber is never under pressure. To operate the machine, the sand hopper, *T*, is filled with sand and the air pressure is turned on by means of the three-way cock, *H*. The escape of the compressed air by way of the tube, *R*, will generate a current of air and by operating the lever at the left, to open the slide valve under the hopper, the sand falls into the air current and is projected against the

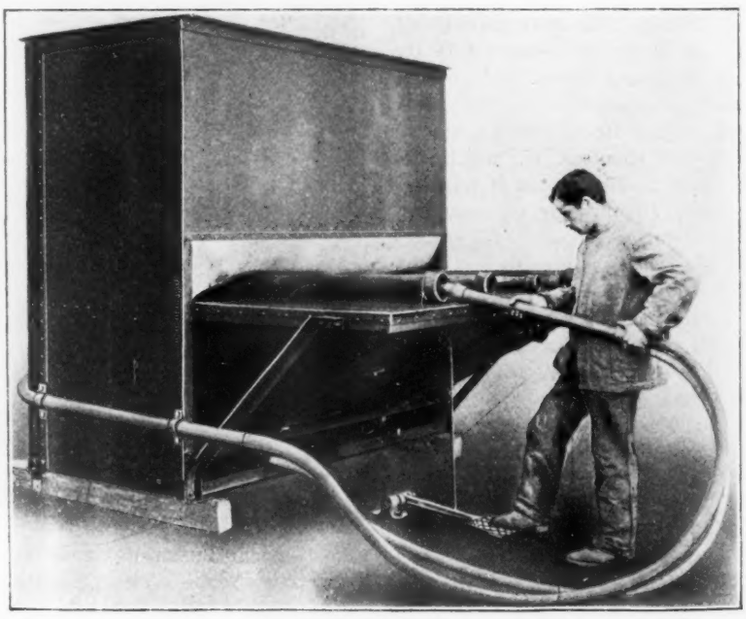


FIG. 4—SAND-BLASTING SOIL PIPE

showing that the air and sand are brought to the vicinity of final discharge before mixing. By this method the sand has a slow movement. There is little or no wear until mixing takes place, so that the wear of the parts is localized. But it is not merely work of the character shown in the illustration to which the hand nozzle is applicable. In Fig. 4, this style of apparatus is shown used in connection with a dust exhauster. A regulating cock with foot control enables the operator to manage the sand blast to advantage. There is a sand receptacle below the table where the sand is collected, permitting it to be used again.

Sand Blast House.

In Fig. 3 is shown a sand blast house. The work may be introduced through a sliding door by a mechanical conveyor and is operated upon by the hand apparatus shown in Fig. 4. The operator stands outside and introduces the nozzle where convenient through the canvas curtains, on both sides, and observes the progress of the work through the windows. The dust is carried off through openings in the roof, by means of a centrifugal exhauster.

This blast house protects the operator and still enables him to control his work. The sand, when used, passes through a sieve and drops into a sand receptacle, from which it is conveyed by a worm screw, to one end of the house. From this point it is raised by

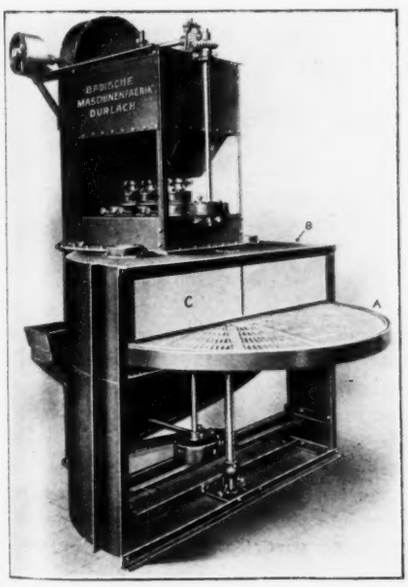


FIG. 5—SAND BLAST PROVIDED WITH A ROTATING TABLE

a sand elevator and discharged into a chute, *A*, which carries it out of the house.

Another method of using the sand blast is in connection with the tumbling barrel. One or more nozzles are introduced into a tumbling barrel, all deriving their currents of mixed air and sand

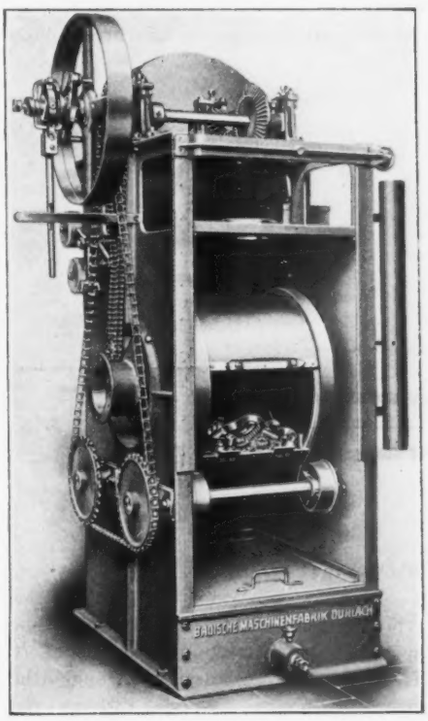


FIG. 6—GERMAN TYPE OF COMBINED SAND BLAST AND TUMBLING BARREL

from a supply pipe arranged along the axis of the barrel. It is necessary, in addition to the rotation of the barrel, to have a longitudinal movement, either of the nozzles or the barrel, or a single nozzle may be given a reciprocating, angular movement, in order to command the entire contents of the barrel. By such an arrangement, the advantages of the sand blast and the tumbling barrel may be combined, and the roughness of the operation of tumbling is reduced to the minimum, so that castings having frail and delicate parts can be handled advantageously, as the sand blast accomplishes the cutting and cleaning desired, the work of the rotating barrel being confined to turning the pieces, which is accomplished very slowly, in some cases only one rotation per minute.

The swinging barrels or swinging nozzles are both discarded in the machine shown in Fig. 6. The barrel itself is arranged in a casing or frame in which it rests on four live wheels or rollers, from which it receives its slow rotary motion. The driving mechanism is seen on the outside of the casing. The blast is not sent through nozzles, but through a long slit extending the length of the barrel. This nozzle is so constructed that it remains fixed during the operation of the barrel, but can be turned for adjusting, and the barrel revolves around it.

The tumbling barrel is not advisable for heavy pieces, approximately greater than 20 pounds in weight. For castings of medium size the rotating table, Fig. 5, may be used in connection with the sand blast. The table, *A*, rotates on a vertical axis which carries it in and out of the casing, *B*. A curtain of flexible material, *C*, forms the face of the casing above the table. A supply pipe overhangs the portion of the table within the casing, and from this pipe, one or more nozzles depend and so command the rotating surface. The operator places the castings on the table as it passes before him and the castings pass into the compartment where they are sand-blasted by the nozzles. When the work reappears, the operator can examine it and also turn it so that when it re-enters, the blast may act on other parts than those already operated upon. As the castings on the circumference of the table pass the corresponding nozzle faster than the ones near the center, the action of the sand blasts are not equal along the radius of the table. To compensate for this, the arm carrying the nozzles may be given a reciprocating, rotary motion in a horizontal plane, from a center beyond the circumference. This effects a more uniform distribution of the blast.

The dust is drawn off by a suction apparatus and the work passes out readily past the curtain, but because of the suction the dust remains inside of the

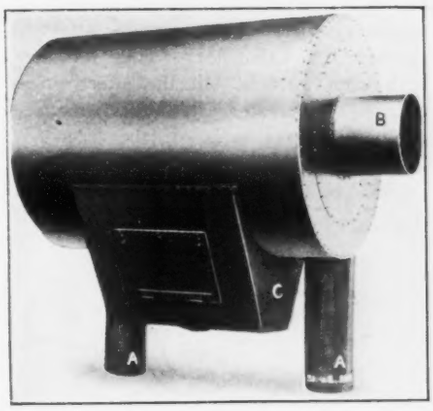


FIG. 7—CENTRIFUGAL DUST COLLECTOR AND SEPARATOR

casing. The machine is shown in operation in Fig. 1, and it will be seen that it is capable of handling a wide range of work.

One of the difficulties that arises in connection with the use of the sand blast is the final disposition of the dust contained in the air drawn off by the exhausters. Indeed, it appears as if the more effectively an exhauster operates,

the greater the problem becomes, for the dust drawn off is a cutting agent and the greater the speed given it by the exhauster the greater will be its destructive effect. One problem is to draw off the dust effectively and yet not give rise to damaging wear on the apparatus. Another problem is the disposition of the dust laden air. If it is discharged into the open air, a serious nuisance will be created. One method has been to discharge the mixed air and dust into what the Germans call a *zyklon*, where the velocity is lost and the dust settles. The disadvantage of this is that the parts of the exhauster are exposed to the cutting effects of the dust passing through it on the way to the *zyklon*. An effort to overcome this has been made by interposing a screen or filter in the current before it reaches the exhauster. This has met with some success, but the effectiveness of the exhauster itself is reduced through the resistance of the filter.

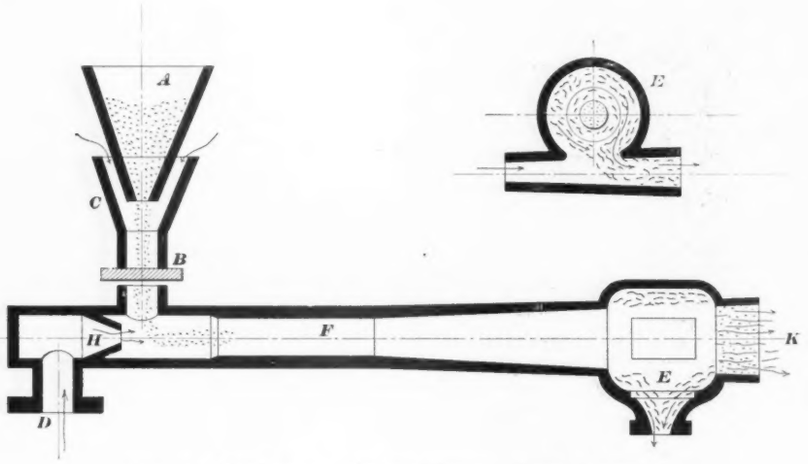


FIG. 8—MATHEWSON STEAM-DRIVEN SAND BLAST

The apparatus shown in Fig. 7 is a centrifugal sand and dust collector. In this chamber the dust laden air from the blast house is swirled, resulting in the separation of the dust from the air. There are no moving parts in the apparatus, which consists of three hollow cylinders, one within the other, the one in the center extending outwards at *B*. The air and dust enter through the pipes, *A*, which continue through the outer compartment and discharge into the middle compartment at a tangent to the circumference, so that the air and dust swirl around, and guides in this compartment direct the swirl in the manner of a screw thread. The current coming in at the right is conducted around to the left, and the one entering at the left passes to the right. This swirling motion permits the centrifugal motion to come into play and the outward impulse is much stronger with the heavy particles of sand than with the air, so that the dust is hurled through the openings in the wall of sheet metal which separates the two cylindrical shells, while the air particles feel the outward impulse but feebly. Thus the two air currents, coming in through *AA*, are brought close to each other, while at the same time they lose their burden of dust. Through suitable apertures, these two currents of air then pass into the innermost cylinder and pass out at the opening, *B*. There is then a single current of comparatively pure air, which is conducted to the exhauster. The dust which is hurled into the outer compartment loses its velocity by being driven against the outer shell, and drops into the receptacle, *C*.

This centrifugal apparatus, however, does not absolutely separate all dust and air, but it serves to reduce the cutting effect on the exhauster to the minimum. The content of dust may be further reduced by an arrangement of the delivery pipe running to the exhauster. This pipe, from the separator, drops vertically into a receptacle containing water, the air being drawn off through a horizontal pipe which taps the vertical pipe just above the surface of the water. The air current, therefore, must make a sharp bend just before reaching the exhauster, which brings centrifugal force into play again, and the down-coming heavy particles fly on past the opening in the vertical pipe and drop into the water. The level of the water should be constantly maintained so that the bottom of the vertical pipe is submerged.

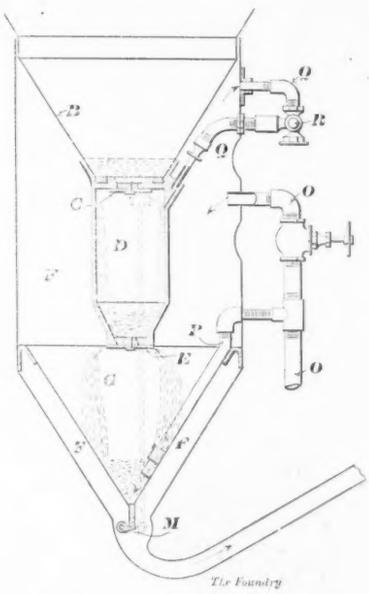


FIG. 10—ENGLISH SAND BLAST IN WHICH A MIXTURE OF SAND AND WATER IS PROJECTED EITHER BY STEAM OR COMPRESSED AIR

A convenient position for the centrifugal dust collector is on the top of the blast house. The discharge would then naturally drop to the floor level, where

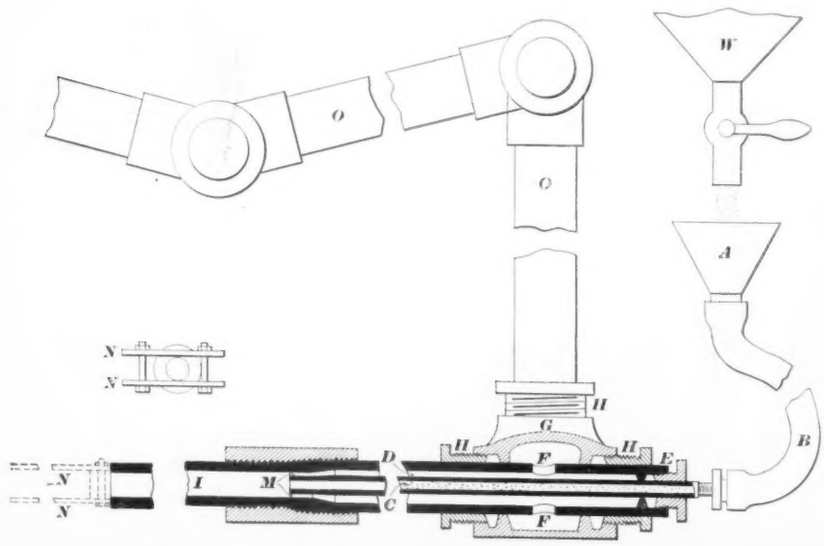


FIG. 9—EARLIEST TYPE OF STEAM-DRIVEN SAND BLAST

the water trap is located, and from this point to the exhauster.

A dust collector is shown at *B*, Fig. 1, the discharge pipe, *C*, being curved before it could be turned downwards, which shows how local conditions may affect such installations.

Theory and Practice in the Foundry*

By W. Sherburn

THE conditions under which the foundryman's working life begins, develops and continues compel him to be intensely practical. Practical work, well done, is the only kind by which he will profit. What wonder then if in the past he has given little or no thought to theory, seeing that so many of his fellows have gone through life and have done good work apparently without it. Complex and fascinating as is the art or craft of the foundryman in its higher branches, the elementary operations are so simple that a boy may begin practical work on the first day he enters the foundry. Given a shovel, a riddle and a rammer, together with hands and feet, some sand, flasks and a pattern, the creation of useful objects in metal may begin almost immediately. Thus we see that after learning the use of these simple implements and observing successive operations and their results, an experience is acquired which begets confidence, and assures success, in most cases, without troubling about knowledge acquired from books, or the thing called theory.

On the other hand far too frequently has the theorist been the man without practical experience who might criticise and dogmatize on the work done, but who could not attempt, practically, to correct any of the mistakes so easy to find. Coupled with this is the fact that theory is usually taught in class rooms or from books, far away from practical operations, and thus an unfortunate separation has grown which it is one of the chief objects of the British Foundrymen's Association to remedy. The practical foundryman, with little or no technical training, has proved that experience combined with judgment and that sixth sense, which often makes him discard unsound principles and reject unsuitable materials, can overcome the innumerable difficulties realized, yet not understood, which are ever before him. There is no doubt, however, that a theoretical knowledge of the principles underlying his work, as well as of the materials used, would lessen his difficulties in so far that the cause of such troubles would be better understood, for when the root of the trouble is located the remedy is much nearer at hand.

The present position of the foundry trade speaks volumes for the work of the practical men in the business, but the increasing competition from within, together with the attempts which are being made to replace iron castings by other materials, often successfully, are factors which cannot be overlooked. It is not sufficient to say that ironfounding cannot be superseded; we are not in a position to judge what the future will bring. It is our duty to see that the advance in civilization is accompanied by an increase in the importance of the foundry trade as one of its allies. Our position must, consequently, be not of defense, but of attack, for any other than a progressive policy at this time will tend to relegate our industry to a position among the lost arts.

The theoretical aspect of the making of molds is, perhaps, confined to two or three considerations:

The design of the pattern, to obtain uniform thickness and few sharp angles, in order to prevent, as far as possible, internal strains and stresses consequent upon different rates of solidification and forms of crystallization.

The disposition of runners and risers to obtain an even rate of cooling.

An elasticity of mold and core to insure that unnecessary strains and stresses will not be set up in the castings during contraction in cooling.

The area of gates and runners requisite to obtain clean castings.

Solidification of Cast Iron.

Molten cast iron, as is well known, consists of a number of compounds dissolved in pure iron. The solidification of such a liquid containing

*From a paper presented before the Lancashire branch of the British Foundrymen's Association.

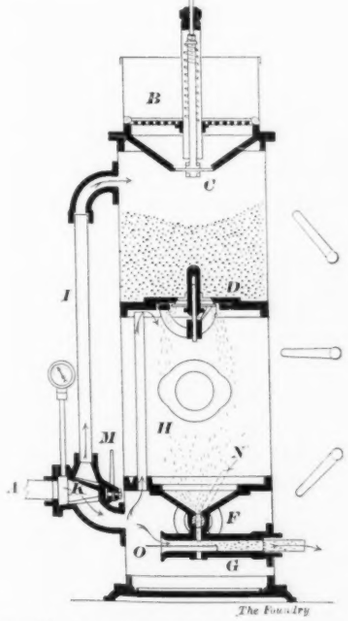


FIG. 11—SECTIONAL VIEW OF GERMAN SAND BLAST TANK

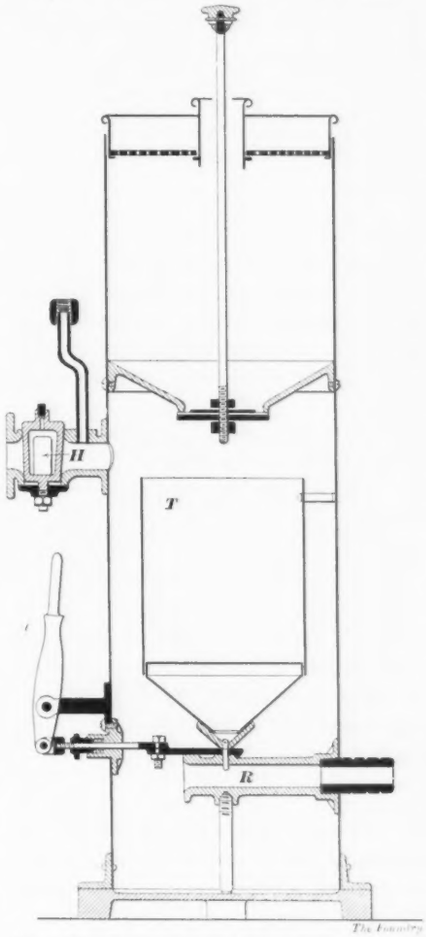


FIG. 12—SECTIONAL VIEW OF A SIMPLE, ENGLISH SAND BLAST TANK

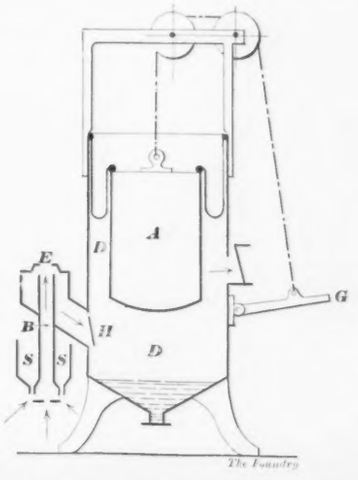


FIG. 13—VACUUM SAND BLAST MACHINE

these compounds, all of which have their own melting points, is consequently a complex matter, and it may be worth considering, briefly, the process of solidification in an iron casting. When the mold is filled, crystallization commences immediately. The walls of the casting in contact with the mold are first solidified owing to the rapid absorption of heat from the molten metal by the mold. The dimensions of the casting are, therefore, determined practically as soon as the pouring operation is completed.

The formation of crystals begins from the outer surface of the casting that is in contact with the sand walls of the mold, and continues toward the center. The crystals build upon the solidified metal toward the center of the mass while shrinkage goes on all the time, and as the solidified outer shell cannot follow this internal contraction, it results in the center of the casting being porous and spongy.

In the case of heavy castings the difficulty is overcome at times by the use of feeders, but there are instances where it is not convenient to use this form of remedy, and in others the use of feeders would be detrimental.

In the case of light castings there is a drawing of the metal in the vicinity of the heavy portion with a consequent loss of thickness in these places. It is necessary, therefore, to have a minimum of inequality of thickness, and an increase in the thickness of the casting at the places likely to be drawn away. It may be said that the iron mixture could be so regulated as to prevent the occurrence of the above difficulty, but while it is possible to reduce the evil considerably, by the use of an iron mixture having a minimum of shrinkage, ideal conditions will not be realized until it is possible for the soldification to commence and continue equally throughout the entire casting. If this were possible, the problem of porous and spongy castings would be solved.

Strains in Castings.

Other points of interest in the solidification of cast iron are the enormous strains and stresses set up in a casting owing to the resistance of the outer walls to the contraction of the interior during the process of cooling. In heavy castings it is not so easy to observe this action as in the case of light castings varying from ⅛ to ¼ inch in thickness. In the latter case there are times when the utmost difficulty is experienced in obtaining castings which will not crack with the slightest shock. It might be said that the difficulty is due to bad design, but it is often necessary to produce castings which, from the foundry point of view, are badly proportioned. The cause of springing or cracking in light castings is usually found to be due to uneven rates of cooling, often exaggerated by the use of unsuitable gates. In the case of extremely thin castings it is often necessary to break off the gates immediately after the casting is poured, to prevent springing, while in other cases the remedy is to change the position of the gates. The judicious use of flat gates is also beneficial, although greater care is necessary with their use, otherwise dirty castings will result. Flat gates are much more in favor in continental foundries than in Great Britain and lighter castings are more common.

Straight Flat Castings.

The question of camber is perhaps the most troublesome problem connected with the production of light castings of any size. Castings of simple shape do not present much difficulty in this respect, but the majority require some attention. There are two methods by which castings of fairly large surface may be obtained in a straight condition. By casting from a pattern which is bent in the opposite direction to which the casting will warp, and by baring the casting in certain parts soon after being run, when a straight pattern is used. The former is the most reliable method, but where only one or two castings are required and the time and expense of making a correct pattern is not warranted, the latter method may be successful with a little experience. The chief disadvantage of the latter system is due to the strains which are liable to be put on castings through the partial exposure and rapid cooling at a comparatively high temperature.

While the position of runners and gates is an important matter to foundrymen their area presents an aspect of the problem which, perhaps, has not received the consideration it deserves. Providing the sand has been strong enough to withstand the wash of the metal, the foundryman has often been satisfied to omit a consideration of the runner area. This problem, however, deserves more attention, and in light castings practice often makes all the difference between good castings and scrap. A runner, from the theoretical point of view, should be so constructed that it is full of metal during the whole period of pouring, as the metal then has less friction upon its sand walls owing to a thin film of iron which forms and protects them, and, consequently, there is less liability for sand to become detached and washed into the mold. Numerous instances have come before my notice where dirty castings have been due to defects in this respect, and on pointing out the area of runner necessary to keep the gate full of metal in casting certain plates that required numerous gates, the molder was not only astonished, but difficult to convince, that his practice was wrong.

If, for example, assuming that we have a runner about one foot long, it follows that in the event of its being of the same diameter throughout, the lower part will deliver metal at a greater rate than is possible in the upper part, owing to the increased pressure at the bottom caused by the head of metal. Consequently, a runner of such description is never full of metal until the pouring of the casting is completed. Runners and gates should, therefore, be constructed so that their area gradually decreases from the head towards the mold and the only check should be at the point of entrance to the mold. By this means a quick-filling of the entire runner is attained, a most important point if clean castings are desired. There may, of course, be occasions when it might be difficult to construct runners on these lines, but the principles involved are worth bearing in mind.

Mixing Iron by Analysis.

Mixing foundry iron by analysis permits the standardization of cupola charges, with modifications to suit the various classes of castings, and here the foundryman is much better situated if he has a knowledge of the various elements in cast iron and understands their influence. He then knows the characteristic properties of certain brands of pig iron and by studying the analyses of various irons, is often able to so blend them as to produce mixtures equal in every respect to those obtainable by the use of high priced special brands. It also often happens that inferior irons can be worked into the charges for some castings, which, without a knowledge of their chemical composition, would give nothing but trouble. In fact, from the analyst's points of view it might be said that there are no bad irons, all they require is blending with other brands deficient in the elements which they possess, or vice versa.

THE BRASS FOUNDRY

The Production of Patterns for Artistic Bronzes

By George H. Mould

IN THE production of patterns for ornamental or artistic metal work, great economies can be effected by the selection of a duplicating design that can be transferred to other patterns, without the necessity of modeling more than the one design. On the cash register, shown in Fig. 2, the end castings A and B, are adapted for one side of the machine only, as the ornamentation cannot be transferred. Consequently, a separate design must be modeled for both right and left sides. Fig. 3 illustrates what is meant by a duplicating design, as the ornamentations can be separately produced and laid out on a plain pattern from which the working patterns are cast in bronze. Thus, not only right and left, but other patterns can be made, as the design, while highly ornamental is merely a duplication of similar figures on a flat back ground. The design should be drawn with the shrinkage allowance added. The design is transferred to a block of plaster of paris and modeled thereon in clay, and for this purpose, the ordinary clay used by sculptors is not suitable, as the moisture it contains is absorbed by the plaster block and the clay dries and cracks. Artificial or composite modeling clay is, therefore,

FIG. 1—ORNAMENTAL FACE OF A BRONZE DOOR KNOB

used for this purpose, as it always remains plastic. Being largely composed of sulphur and grease it does not stick when the plaster is poured over it, and may even be used for sand molds if well dusted with lycopodium. The ornamentation is modeled in relief on the plaster block, conforming as nearly as possible to the design, and when this is completed a cast is taken off in plaster of paris. This is accomplished by placing a wall of cardboard or clay around the plaster block, so as to confine the liquid plaster when it is poured over the surface of the block. This confining wall should be sufficiently high to leave enough plaster over the highest points of the model, not only to cover them, but to give the cast sufficient strength to withstand handling without being broken. The plaster should be mixed to the consistency of thick cream, and should be poured slowly from one end of the mold to force out the air and thus avoid blow-holes in the cast.

When the plaster cast has set, it is removed from the pattern and will contain the design in reverse, so that it is necessary to take another cast from this reverse, in order to obtain

FIG. 2—CASH REGISTER WITH ORNAMENTAL ENDS WHICH CANNOT BE DUPLICATED

FIG. 3—CASH REGISTER WHOSE ORNAMENTATIONS ARE MADE UP OF DUPLICATED DESIGNS

the modeled design in relief. To accomplish this, the reverse cast is trimmed while somewhat soft, when it can be easily cut. The cast is next coated with a solution made of one part of tallow candle and two parts of kerosene, the tallow being melted in the kerosene which is heated in a water bath or by steam. This will prevent the plaster surfaces from adhering. In addition to the coating the reverse mold should be soaked in cold water for 10 or 15 minutes before the plaster is poured. It will be necessary to place a wall around the reverse mold to confine the plaster as in the first instance. After the cast has been made the two parts of the mold should be allowed to remain together until cool, when they are carefully parted so as not to break away any of the small or deep ornamentations. The design is thus obtained in relief in plaster of paris, and the next operation is to wash off the model, and work up the details with the exception of the matte surfaces, which should never be attempted on the plaster mold, as they seldom show well on the bronze castings. It is better to chase the matte on the bronze pattern.

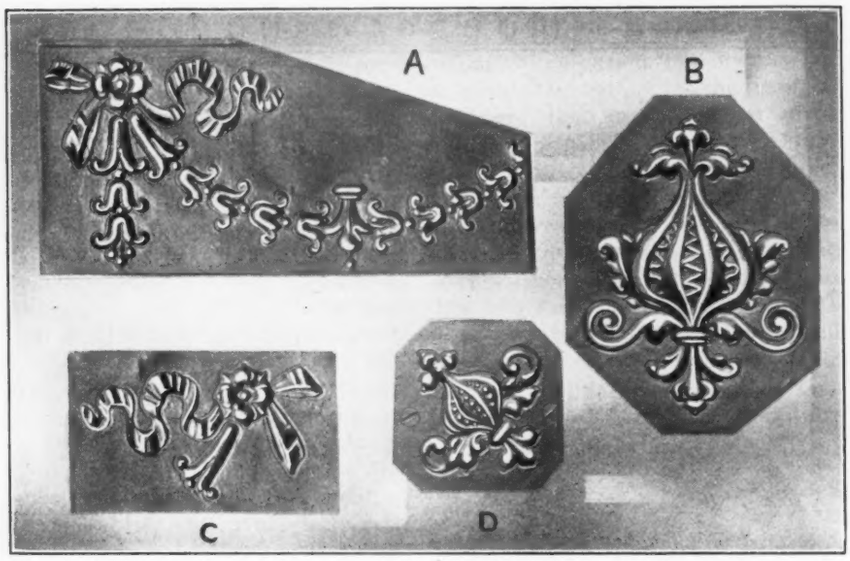


FIG. 4—DUPLICATING MASTER PATTERNS

As previously stated, the ornamentation on the cash register, Fig. 3, can be duplicated, and a satisfactory method of doing this is by the electrotyping process. It will be noted that the ornamentation on Fig. 3 is duplicated around the design, and it is only necessary to model one ornament of each kind, A, B, C and D, Fig. 4. A casting in bronze is made from each of these designs, and after they are properly chased, a small groove is cut around the edge of the ornament with a tracer. This forms a small ridge on the back of the electrotype, outlining the design, and by filing off this ridge the ornament is detached from the background and is free from fins. The electrotypes can be readily obtained at a trivial cost when compared with the expense of modeling. When the electrotypes are received, they are fastened to a sheet of brass, 3/32 inch in thickness, with white shellac, to form the pattern. The backs of the electrotypes are coated with white shellac and they are laid in the proper position on the brass plate, and are attached by heating with an alcohol lamp which is held underneath the plate until the shellac boils out from underneath the ornament. The surplus shellac is removed by a sharp, pointed instrument and the patterns are then brushed with pulverized pumice, using a hard brush. This produces a pattern from which a large number of molds can be made.

The electrotyping process is adapted to a wide variety of work, such as door knobs, hinges, escutcheon plates, and in fact for any pattern that is to be duplicated. For instance, the ornamented part of the door knob, Fig. 1, is first modeled and a casting made and finished. This is sent to the type foundry and eight electrotypes are made therefrom. These can be then soldered to the patterns of the lower or plain part of the knob, and thus a gate of patterns can be obtained at a small cost.

While the patterns are being chased they are embedded in a block composed of two parts of green or brewer's pitch, and one part plaster of paris. These ingredients are melted in an iron pot and thoroughly mixed with an addition of a tallow and rosin. This makes a very hard bed for holding the castings in position and one that is readily softened by the application of heat. While the pattern must be firmly held, its position must be frequently changed and to permit this to be done, the pitch is contained in the large cast iron bowl, Fig. 5. It will be noted that this bowl is a half sphere, and when set in the stand B, can be readily shifted to any position. This stand may be a ring of wood or metal about 6 inches inside diameter, or it can be formed of a piece of leather belting rolled into an open coil. While the pattern is held firmly, the bowl can be turned in any direction, as it is necessary in chasing to be able to work from all sides and angles. Chasing requires much skill, patience and an artistic eye, as a poor chaser can spoil the finest design in a very short time. A large number of tools are required for this work, including a variety of matte tools for backgrounds. By the use of the electrotyping process, much time is saved in chasing as the details of the master pattern are accurately reproduced.

Finely engraved and ornamental patterns require care and skill in molding to obtain castings that will do justice to the patterns and the first requisite to this end is fine molding sand. The patterns are first covered with a facing composed of a mixture of fine brass sand, ground and mixed with charcoal dust. The facing is backed by heap sand, which is tucked around the pattern and the sides of the flask, and uniformly rammed. When the pattern is drawn, the impression is first dusted with fine sand from a bag, and then with charcoal dust. The pattern is then

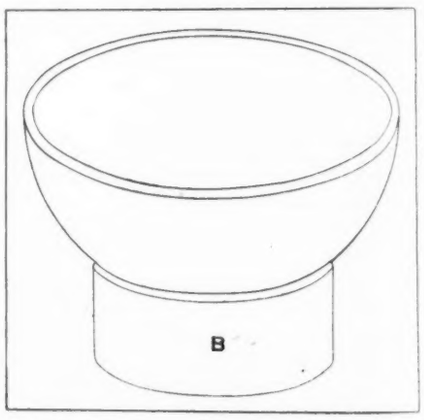


FIG. 5—STAND AND BOWL IN WHICH PATTERN IS HELD FOR CHASING

returned, the mold is rammed lightly and finished by smoking with rosin, being afterwards skin-dried. The work is poured face down and the mold is inclined at an angle of about 60 degrees. This method will insure good, clean castings, free from dross or other imperfections, providing a suitable metal is used, and for this purpose the following alloy is recommended: Copper, 1¾ pounds; tin, ½ ounce; lead, ½ ounce; zinc, 3½ ounces; or, if yellow brass is required, the following alloy can be used: Copper, 1 pound; zinc, 8 ounces; lead, ¼ ounce.

A cheap and successful method of making name plates involves the use of a piece of sheet brass, to which a border is attached of the same height as the letters, approximately 1/32 inch. The face of the plate enclosed by the border is then filled with a mixture of white wax and a small amount of English vermillion, heated and mixed together. The surplus wax is scraped off level with the border and the letters are either traced on the wax, or are transferred from transfer paper. The wax between the letters is cut away with a sharp knife. The letters should be given sufficient draft to mold easily and the result is a good, cheap master pattern, from which a bronze casting is made, which, when chased and the matte background put in, forms the permanent pattern from which electrotypes can be made if a gate of patterns is required. In making plaster models, only the best dental plaster should be used to obtain the best results, and if at any time it is necessary to preserve the plaster casts, they can be made very hard by adding one tablespoonful of dextrine to one-half pail of plaster.

Brass Foundry Difficulties

SOLVED BY EXPERTS

Red Metal Mixture

We would like to obtain a formula for a red metal suitable for making bond lugs. The metal should be quite soft as the lugs are riveted to the rail.

The following alloy will be found suitable: Copper, 88 pounds; tin, 3 pounds; zinc, 6 pounds, and lead, 3 pounds. A cheaper alloy consists of: Copper, 70 pounds, and zinc, 30 pounds.

Non-Ferrous Alloys

Will you kindly favor us with a formula for each of the following alloys: Yellow brass, composition, and phosphor bronze? We would like to obtain first-class mixtures.

The following alloys can be recommended: Yellow brass—Copper, 70 pounds; zinc, 26 pounds; tin 2 pounds; lead 2 pounds. Composition—Copper, 88 pounds; tin, 6 pounds; zinc, 3½ pounds, and lead, 2½ pounds. Phosphor bronze—Copper, 90 pounds; tin, 5 pounds, and phosphor tin, 5 pounds.

German Silver

Can you give us a mixture for a non-corrosive white bronze alloy? We would like to have this as cheap as possible and at the same time to have a tensile strength equal to malleable iron, taking a polish like nickel.

The only alloy that will meet all these requirements is German silver, and you will probably find it cheaper to use scrap than new metals. A low-priced alloy is as follows: Copper, 60 per cent; zinc, 25 per cent; nickel, 15 per cent. Melt the copper and the nickel together, then add the zinc. Should this be too yellow for your purpose it will be necessary to add more nickel, which increases the cost of the alloy, but if you wish to imitate polished nickel in appearance, an alloy of 2 parts copper and 1 part nickel is the best you can do. It is possible, however, that Monel metal would meet your requirements, both as to cost and appearance. For particulars regarding this alloy see THE FOUNDRY, October, 1910, page 69.

Pin-Holes in Bronze

We have experienced much trouble, from time to time, with the following alloy: Copper, 90 pounds; phosphor copper, 5 pounds, and lead, 5 pounds. The metal rises up in the sprue a moment or two after being poured and the castings always contain pin holes. Can you tell us how to overcome this difficulty? We would also like to obtain a formula for a dip for yellow brass.

This is a peculiar alloy, and we could have advised you more definitely if the purpose for which it is intended had been given, as it is possible a better mixture could have been suggested. Whatever its uses may be we advise a change, and suggest the following alloy: Copper, 90 pounds; phosphor-copper, 3 pounds; tin, 2 pounds, and lead, 5 pounds. This change is advised because it is difficult to make an alloy of copper and lead alone, and in case an anti-acid mixture is desired, the alloy given will be equally as good for that purpose as the all-lead mixture and it is more easily cast. The pin holes, however, are due to the burning of the metal while in the furnace, and we advise the use of charcoal and greater care in melting. A formula for a bright dip for brass, follows: Sulphuric acid, 3 quarts; nitric acid, 2 quarts, and salt, 1 tablespoonful.

Low Shrinkage Alloys

We wish to line some cast iron cylinders that have no wearing surface, with an alloy that will cast equal to die-casting metal with reference to accuracy, and will have practically no shrinkage, be fairly hard, and as inexpensive as possible.

An alloy that has a minimum shrinkage can be made by adding 5 pounds of bismuth and 5 pounds of antimony to 90 pounds of half-and-half solder. This alloy, however, is expensive, therefore it may be necessary to use an alloy of normal shrinkage on account of the cost, and the following alloys will probably afford a selection: (1) Lead, 75 per cent; antimony, 15 per cent, and tin, 10 per cent. (2) Lead, 80 per cent; antimony, 10 per cnt, and tin, 10 per cent. (3) Lead, 85 per cent; antimony, 10 per cent, and tin, 5 per cent. Any of the alloys, here given, can be used for die casting, and will cast with accuracy, providing the mold or die is accurate.

Modeling Wax

Can you give a formula for making modeling wax?

Wax for modeling purposes can be made as follows: White wax, 6 pounds; lard, 1 pound, and zinc white, 1 pound. Melt the wax at a gentle heat, add the lard and stir in the zinc white and color with vermillion. Another formula follows: White wax, 20 parts; oil of turpentine, 4 parts; sesame oil, 1 part, and vermillion, 2 parts. Melt the wax, stir in the turpentine gradually, add the other ingredients, pour onto a slab to cool, remelt and pour into tepid water and knead until plastic.

Arrangements for the Foundrymen's Convention at Pittsburg

Program of the meetings of the American Foundrymen's Association, American Brass Founders' Association and Associated Foundry Foremen--Big exhibit of foundry supplies and equipment

AT A meeting of the Pittsburg Foundrymen's Association, held on Monday evening, May 1, final preparations for the foundrymen's convention, which will be held in Pittsburg, May 23 to 27, were made. Reports of the various committees were received and arrangements were made for the reception and entertainment of several thousand visitors. The report of the committee on papers was particularly gratifying, as both in number and variety the papers already in hand and promised, foreshadow a full and interesting program. Separate meetings of the American Foundrymen's Association and the American Brass Founders' Association will be held, although the convention will open with a joint session of the allied organizations at 10 o'clock, Tuesday morning, May 23. The exhibit of foundry supplies and equipment in the buildings of the Western Pennsylvania Exposition Society, where the meetings of the various associations will also be held, will be formally opened at 7 o'clock, Tuesday evening. Morning and afternoon sessions of the American Foundrymen's Association and the American Brass Founders' Association will be held until the close of the meeting, with the exception of Wednesday and Friday afternoons, which have been set apart respectively, for an excursion to the Westinghouse plants and steel works, and to the ball game at Forbes field. On Wednesday, evening the Associated Foundry Foremen will give their annual dinner, and on Thursday evening a vaudeville entertainment will be held by the Foundry & Machine Exhibition Co., to which all of the properly accredited visitors will be invited. On Friday evening, a subscription dinner will be given which will be open to all who attend the convention.

Convention Committees.

The committees in charge of the convention arrangements, follow:

Executive committee.—Joseph T. Speer, chairman; F. H. Zimmers, secretary; J. H. Seaman, chairman of the finance committee; W. A. Bole, chairman of the plant visitation committee; G. P. Bassett Jr., chairman of the ladies' entertainment committee; E. D. Frohman, chairman of the ball game committee; W. B. Robinson, chairman of the press committee; H. E. Field, chairman of the convention committee, and Eliot A. Kebler, chairman of the reception committee.

Plant visitation committee.—W. A. Bole, chairman, Westinghouse Machine Co.; Samuel Sleeth, Westinghouse Air-brake Co.; C. W. Jones, Rosedale Foundry & Machine Co.; H. M. Wilson, Taylor-Wilson Mfg. Co.; J. A. Logan, Jones & Laughlin Steel Co.; J. P. Allen, Union Steel Casting Co.; H. W. Petty, American Steel Foundries; W. H. Denman, Pennsylvania Casting & Machine Co.; Louis K. Ely, Monessen Foundry & Machine Co.; C. J. Mesta, Mesta Machine Co.; M. L. Heyl, Herman Pneumatic Machine Co.; Geo. Rollings, Pittsburg Malleable Iron Co.; C. H. Gale, Pennsylvania Malleable Co.; G. W. Knotts, United Engineering & Foundry Co., and L. A. Way, Duquesne Steel Foundry Co.

Permanent mold and cupola exhibit committee.—H. E. Field, chairman; C. F. Knowlton, John Logan, C. H. Gale and H. P. Spilker.

Registration committee.—H. E. Field and W. W. Sanderson

Committee in charge of subscription banquet.—H. E. Field, chairman; Jos. T. Speer, J. S. Seaman, W. A. Bole, F. H. Zimmers, E. D. Frohman, E. A. Kebler and G. P. Bassett, Jr.

The registration of the various members of the different associations and of the visitors will be conducted in a similar manner to the registration at Detroit last year. Each person is requested to register in the name in which the membership is entered in the various foundrymen's organizations. If John Jones is representing John Brown & Co., and if a member of the American Foundrymen's Association or the American Brass Founders' Association, he will present his card at alphabetical division "B," stating that John Brown & Co. are members of either or both associations, and will register as John Jones of John Brown & Co. The members of the Associated Foundry Foremen will register individually in the proper alphabetical division. The committee also requests that, when convenient, those registering should present their business cards bearing their own and firm names.

Preparations are being made by foundrymen, located in some of the leading casting producing centers, to journey to Pittsburg in special trains and cars. The Chicago Foundry Foremen's Association has arranged for a special train, which will leave Chicago at 8:15 p. m., Monday, May 22, arriving in Pittsburg the following morning. Members of the Philadelphia Foundrymen's Association have chartered a special car, and at Buffalo and Cincinnati arrangements are being made by the foundrymen that will insure a large representation at Pittsburg from both centers.

The Pittsburg Foundrymen's Association, for the second time in its history, will act as host to the American Foundrymen's Association. In May, 1899, the foundrymen held their annual meet-

E. D. FROHMAN
Chmn. Ball Game Com.

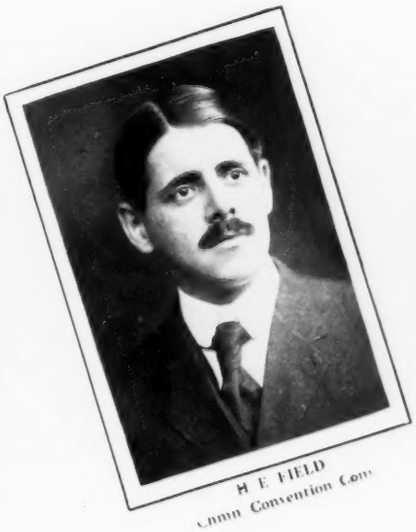
J. S. SEAMAN
Chmn. Finance Com.

ELIOT V. KEBLER
Chmn. Reception Com.

JOS. T. SPEER, Chmn.
President, A. F. A.

W. B. ROBINSON
Chmn. Press Com.

W. V. BOLE
Chmn. Plant Visitation Com.



H. E. FIELD
Chmn. Convention Com.

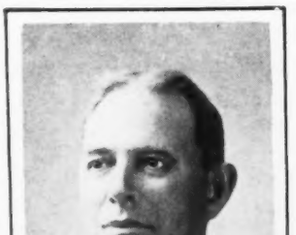
F. H. ZIMMERS
Secretary

G. P. BASSETT Jr.
Chmn. Ladies Com.

COMMITTEE IN CHARGE OF FOUNDRYMEN'S CONVENTION

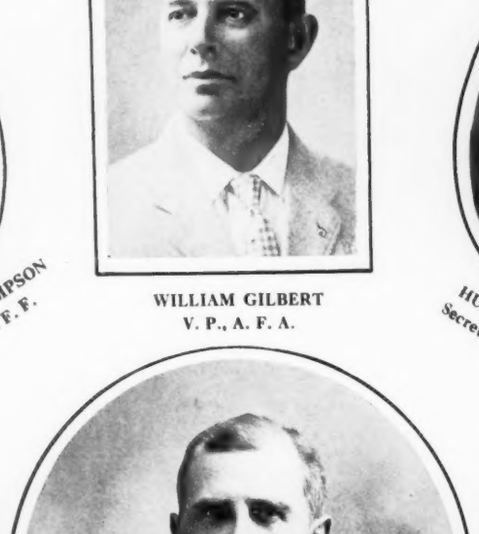
At Pittsburg, May 23-26

ROBERT B. THOMPSON
President, A. F. F.



WILLIAM GILBERT
V. P., A. F. A.

HUGH McPHEE
Secretary, A. F. F.



RICHARD MOLDENKE
Secretary, A. F. A.

T. W. SHERIFFS
V. P., A. F. A.

ALFRED E. HOWELL
V. P., A. F. A.

A. N. W. CLARE
V. P., A. F. A.

J. J. WILSON
V. P., A. F. A.

F. B. FARNSWORTH
V. P., A. F. A.

Officers of the American Foundrymen's Association and Associated Foundry Foremen

ing in the Smoky City, previous conventions having taken place in Cincinnati, Detroit and Philadelphia. The Pittsburg association takes rank among the first of the locals organized. At a preliminary meeting, on July 31, 1896, plans were discussed for the formation of the society, and the formal organization was effected Sept. 11. Officers were elected as follows: Robert Taylor, president; William Yagle, vice president; J. S. Seaman, treasurer, and F. H. Zimmers, secretary. This association is one of the largest, in point of membership, in the country, 140 foundrymen being enrolled. Monthly meetings are held at the Fort Pitt hotel, which are usually preceded by a dinner. Papers on practical foundry topics are read at every meeting, a program committee having this feature in charge.

Cincinnati Foundry Foremen.

At a recent meeting of the Cincinnati section of the Associated Foundry Foremen, held at the Grand hotel in that city, a committee consisting of John A. Logan, F. C. Broerman and F. J. Brunner, was appointed to make arrangements for proper transportation facilities for the Cincinnati delegation which will attend the foundrymen's convention in Pittsburg. The president was authorized to appoint a delegate to represent this local at Pittsburg and to report the result of his observations at one of the monthly meetings. The foundry apprentice problem was one of the questions discussed and a committee consisting of Wm. McIntosh, Chas. Engelhart, J. A. Logan and Wm. Liddell, was appointed and authorized to confer with the officers of various organizations with a view to obtaining all of the necessary information on this subject. President H. M. Ramp, in his annual address, outlined the possibilities of the work that could be done by the local association and pointed out the value of continued co-operation between the executives in charge of all departments of the various foundries in the Cincinnati district which has already resulted in a material improvement in foundry practice. Officers for the ensuing year were elected as follows: Herbert M. Ramp, president; F. A. Elbert, vice president; Wm. McIntosh, treasurer; F. J. Brunner, secretary, and Jas. W. McIntosh, sergeant at arms.

The following standing committees were appointed by President Ramp: Educational, E. L. Binns, John A. Logan and James A. Murphy; entertainment, W. McIntosh, F. C. Broerman and F. J. Brunner; membership, John Hill, H. Schuh and C. Goehringer; auditing, Wm. Liddell, F. C. Broerman and H. M. Roberts.

Honorary members were elected as follows: Prof. J. J. Porter, University of Cincinnati; F. O. Clements, National Cash Register Co., Dayton, O.; John A. Logan, ex-president of the Cincinnati Foundry Foremen's Association, and Prof. Jno. L. Schearer, Ohio Mechanics' Institute.

It was announced that when the building of the Ohio Mechanics' Institute is completed the meetings of the local will be held at that place.

Buffalo Foundry Foremen.

The first annual banquet of the Buffalo Foundry Foremen's Association was held at the Hotel Statler, Buffalo, Tuesday evening, April 25. More than 200 members and guests were present. The proceedings were enlivend by a varied program of songs, music and recitations, and amid the enthusiasm thus engendered the movement was fully launched, that has been on foot for some time, to bring to Buffalo, the 1912 convention of the American Foundrymen's Association and allied organizations.

F. W. Thompson, president of the Associated Foundry Foremen and of the local organization, presided, and the speakers included Dr. Richard Moldenke, secretary of the American Foundrymen's Association; Frank W. Tracy, chairman of the convention committee of the Buffalo Commerce and Manufacturers' Club; William H. Barr, president of the Buffalo Foundrymen's Association; W. M. Corse, secretary of the Brass Founders' Association, T. L. Richmond, W. F. Wendt and Hugh McPhee, secretary-treasurer of the Associated Foundry Foremen.

In his opening address F. W. Thompson gave a short history of the scope and purpose of the foremen's associations and dwelt upon the educational advantages to be derived therefrom. He gave several examples where information gleaned from the papers that had been presented in the past before the association had been turned to practical benefit, by affording a solution of difficulties that reduced the loss from defective castings by several per cent.

Dr. Richard Moldenke followed with an address, the subject of which was "Foundry Economy." Particular stress was laid upon the economies possible in the melting of iron. Improper melting, resulting in the oxidation of the iron, he said, was responsible for many troubles. In the smelting of iron in the blast furnace the heated gases first convert the ore into a spongy mass of iron in the upper portion of the stack, and when in this spongy and heated condition the metal is so susceptible to oxidation that if it were possible to permit the air free access, the iron would absorb oxygen with such avidity that it would be burned up like a flash. Therefore, he added, it is to be expected that with this condition prevailing in the furnace, some oxidation of the iron is unavoidable in its descent towards the melting zone, and the extent to which this oxidation might be carried is, in the speaker's opinion, responsible for much of the variation found in the strength of irons, particularly between charcoal, and coke grades. In melting iron in the cupola, the practice of placing the bulk of the iron charge upon the bed, Dr. Moldenke said was favorable to oxidation and cold melting with their attendant troubles, which could be remedied by the equalization of the charges.

Frank W. Tracy then followed with a hearty endorsement of the plan to hold the next foundrymen's convention in Buffalo, and urged the foundrymen of Buffalo and vicinity to enthusiastically co-operate in the effort to bring the convention to that city.

William H. Barr stated that the employers were in accord with the foundry foremen in every movement that will lead to the advancement of foundry knowledge, and he also favored holding the next convention in Buffalo. On behalf of the Brass Founders' Association, W. M. Corse, secretary, thanked the Commerce and Manufacturers' Club for the invitation to meet in Buffalo next year.

Foundry Equipment Exhibit.

The exhibit of foundry supplies and equipment, which will be conducted in the buildings of the Western Pennsylvania Exposition Society, will be formally opened on Tuesday evening, May 23, and will be continued to June 1, to enable the members of the American Society of Mechanical Engineers, whose summer meeting will be held in Pittsburg, May 30 to June 2, to attend the show. The exhibition building will be open Tuesday and Saturday evenings, and throughout the day from Wednesday to Saturday. This exhibit promises to eclipse all previous shows in both magnitude and variety, and up to May 1 space reservations had been made by 93 manufacturers of foundry supplies and equipment, machine tools, elevating and conveying machinery, lifting magnets, etc. Practically all of the molding machines that will be displayed will be shown in operation and many

new types will be introduced at this time. Metal melting furnaces will also be operated and the two large exposition buildings on Duquesne Way will be converted into model foundries.

The Exhibits.

ADAMS CO., Dubuque, Ia.—A number of Farwell squeezers will be exhibited and a large variety of patterns will be used by the operators for the purpose of demonstrating the ease with which patterns can be changed in the course of a day's work. On one machine will be shown a series of 20 to 25 patterns and molder will change patterns with every mold from 20 to 30 times an hour. Several universal molding machines of different sizes will also be operated; Glenn Muffly, C. F. Reich, W. J. Spensley, John Nicol, L. E. Marceau, Ignatus Schweitering, John Berringer and Anton Haas, representatives.

ALBANY SAND & SUPPLY CO., Albany, N. Y.—The space reserved by this concern will be fitted up as an office where the company's representatives will have an opportunity of receiving friends and customers.

ALLEN-BRADLEY CO., Milwaukee.—

ARCADE MFG. CO., Freeport, Ill.—The molding machines manufactured by this concern will be shown in operation and will include Norcross jarring machines, Modern molding machines, squeezers and an automatic molding machine equipped with a sand elevator and dropper. Other foundry equipment to be shown will include sand sifters, matchplate hinge, etc. This company will also show the method of making pattern plates such as are used in connection with these molding machines; E. H. Morgan, Chas. Morgan, L. L. Munn, F. N. Perkins, R. M. Burton, W. C. Norcross, representatives, and Henry Tscherning, G. D. Wolfley, Aug. Christen, John Ludolph, Joe Stevens, H. Damman, operators.

ATLAS CAR & MFG. CO., Cleveland.—Cars for industrial purposes.

BAIRD & WEST, Detroit.—This exhibit will be made in conjunction with Pickands, Brown & Co., Chicago, and will include a display of Solvay foundry coke; J. A. Galligan, G. A. Long, W. H. Ball and J. A. Ballard, representatives.

BARTLEY, JONATHAN, CRUCIBLE CO., Trenton, N. J.—This concern will exhibit a complete line of stock crucibles, retorts, etc., Samuel H. Dougherty, Lee T. Ward, Herbert D. Cole and Lewis H. Lawton, representatives.

BERKSHIRE MFG. CO., Cleveland.—This exhibit will consist of a full line of foundry equipment, including hand squeezing and pattern-drawing molding machines, plain squeezers and automatic molding machines, as well as a full line of snap flasks, iron flasks, etc.; R. H. York, J. N. Battenfeld and C. F. Battenfeld, representatives.

BLAKE, GEO. F., CO., East Cambridge, Mass.—This concern will be associated with the Clayton Air Compressor Works, New York City, and the Deane Steam Pump Co., Holyoke, Mass. Two sizes of core wire-traightening machines will be shown in operation and the exhibit of the Clayton Air Compressor Works will consist of dust-proof and enclosed frame splash lubricated air compressors, both vertical single-acting, high speed power-driven, as well as a horizontal type which is built both steam and power-driven. The exhibit of the Deane Steam Pump Co. will consist of a pneumatic sand riddle; Frederick H. Thatcher and A. F. Murray, representatives.

BIRKENSTEIN, S., & SONS, Chicago.—Samples of a complete line of brass founders' alloys made by this concern will be exhibited; E. E. Berliner, H. Birkenstein and J. B. Neiman, representatives.

BLYSTONE MFG. CO., Cambridge Springs, Pa.—The core sand mixer manufactured by this concern will be shown in operation; P. L. Blystone, J. A. Bolard, W. E. Wright and J. F. Mather, representatives.

BROWN SPECIALTY MACHINERY CO., Chicago.—The coremaking machines to be exhibited by this concern will include several sizes of Hammer core machines, in addition to cutting-off and tapering machines; John Laycock and Elmer A. Rich, representatives.

BUCH'S SONS CO., A., Elizabethtown, Pa.—This concern will exhibit three combination jar and squeeze molding machines, square and tapered aluminum snap flasks, patented steel flask bars, pattern cement, bottom boards, cast iron castings, cast iron flasks for gravity molding machines with bottom boards and bars, special pouring ladle with bail, in addition to numerous patterns showing method of mounting and a line of sample castings demonstrating work made on different machines manufactured by this concern; R. S. Buch and Geo. E. Bates, representatives.

BUCKEYE PRODUCTS CO., Cincinnati.—Parting compounds, binders, blackings, brass dusts and core compounds will be shown; Charles A. Goehringer and Edward Leisl, representatives.

BURROUGHS ADDING MACHINE CO., Detroit.—A complete line of adding machines will be exhibited, which are particularly adapted to cost accounting departments of foundries; Ward Gavett and H. F. Happer, representatives.

CARBORUNDUM CO., Niagara Falls, N. Y.—This concern will make an exhibit of carborundum and aloxite wheels, carborundum fire sand, paper and cloth, as well as other carborundum products used by foundrymen. Several grinding machines will be installed for the purpose of demonstrating the wonderful cutting powers of a carborundum and aloxite wheels. So far as possible, the grinding will be done under actual shop conditions. These wheels will be used for grinding gray iron, malleable and steel castings; Geo. R. Raynor, W. W. Sanderson, O. C. Dobson, Anthony Dobson, J. P. McCann, C. D. Sargent and H. A. Eaton, representatives.

CHICAGO PNEUMATIC TOOL CO., Chicago.—Air compressors.

CLEVELAND PNEUMATIC TOOL CO., Cleveland.—A complete line of sand rammers, riveting and chipping hammers, air drills, emery grinders and air hose couplings will be exhibited. A number of tools will also be shown in operation.

CLEVELAND WIRE SPRING CO., Cleveland.—A complete line of shop furniture will be displayed, including steel tote boxes, steel foundry barrels, steel kegs, steel shelving, sprue boxes, coiled wire springs, etc.; J. W. Campbell and C. H. Erickson, representatives.

CUTLER-HAMMER MFG. CO., Milwaukee.—Lifting magnet adapted for foundry use will be shown.

DETROIT CORE MACHINE CO., Detroit.—The coremaking machine manufactured by this concern will be shown in operation. It is of the foot-power, jar-ramming roll-over type and is adapted for making small and medium size irregular cores; Augustus N. Kelley and G. Herbert Rounsifer, representatives.

DETROIT FOUNDRY SUPPLY CO., Detroit.—This space will be fitted up as a rest room where foundrymen can meet their

Program of the Pittsburg Convention

Monday, May 22, 2 P. M.

Registration only.

Tuesday, May 23, 9 A. M.

Registration.

10 A. M.

Joint session of the American Foundrymen's Association, Associated Foundry Foremen, American Brass Founders' Association and the Foundry and Machine Exhibition Co.

Addresses of welcome and responses.

Papers to be read and discussed:—
- Production Cost.
- Economic Foundry Insurance.
- Uniform Contracts.

2 P. M.

Meeting of the American Foundrymen's Association.

Papers on the following subjects to be read and discussed:—
- Unloading Methods.
- Use of Borings in Cupolas.
- Effect of Alloys in Cast Iron.
- Permanent Molds.

American Brass Founders' Association.

Papers to be read and discussed:—
- Vanadium in Non-Ferrous Alloys.
- Determination of Nickel in Bronzes.
- Pouring High Grade Bronzes.

7 P. M.

Formal opening of the exhibit of foundry supplies and equipment, under the auspices of the Foundry & Machine Exhibition Co., in the buildings of the Western Pennsylvania Exposition Society.

Wednesday, May 24, 9:30 A. M.

Papers will be read and discussed on the following subjects:—
- Rotary Blowers.
- Foundry Construction.
- Heating and Lighting Systems.
- Patternmaking.
- Molding Machines.

American Foundrymen's Association—Steel meeting:—

Papers on the following subjects will be presented:—
- Acid and Basic Open-Hearth Processes.
- Electric and Converter Furnaces for Steel Castings.
- Effect of Vanadium and Titanium on Steel.

American Brass Founders' Association meeting:—

Papers on the following subjects will be read:—
- Corrosion of Brass Foundry Products.
- Pyrometer and the Aluminum Foundry.
- Non-Ferrous Foundry Economies.
- Equilibrium Diagrams.

6:30 P. M.

Dinner of Pittsburg and Associated Foundry Foremen.

Thursday, May 25, 9:30 A. M.

Joint Session.

Papers on the following subjects will be read:—
- Measuring Temperatures.
- Molding Sand.
- Use of Alloys.
- Shot in Castings.

1 P. M.

Train excursion to foundries and steel works in the Pittsburg district.

8 P. M.

Entertainment by Foundry & Machine Exhibition Co. to members of all associations and their guests in attendance at the conventions.

Friday, May 26, 9:30 A. M.

Separate meetings of all Associations for the election of officers.

3:30 P. M.

Pittsburg and Cincinnati ball game at Forbes field.

6:30 P. M.

Subscribtion dinner open to all who attend the convention or exhibition.

Saturday, May 27.

The exhibition of the Foundry & Machine Exhibition Co. will be open throughout the day and evening.

friends: M. Z. Fox and W. Bruce Howard, representatives.

DETROIT HOIST & MACHINE CO., Detroit.—This exhibit will consist of pneumatic geared hoists, pneumatic motors and pneumatic winches; J. C. Fleming, F. L. Bromley and F. J. Martin, representatives.

DIXON, JOSEPH, CRUCIBLE CO., Jersey City, N. J.—A complete line of graphite products, including crucibles, retorts, skimmers, etc., will be shown; F. R. Brandon, John A. Condit, Frank Krug and D. A. Johnson, representatives.

ELECTRIC CONTROLLER & MFG. CO., Cleveland.—A lifting magnet, 43 inches in diameter, will be shown in operation lifting pig iron and miscellaneous scrap. This magnet will be supported and operated from an A-frame equipped with a Euclid Crane & Hoist Co.'s 5-ton I-beam trolley, which will be provided with a 5-horsepower controller manufactured by the Electric Controller & Mfg. Co. A one-horsepower, 220-volt automatic motor starter controlling a one horsepower motor will also be shown in operation and the exhibit will include, in addition, a 25-horsepower automatic motor starter and a 25-horsepower, 220-volt hoist controller; J. S. McKee, J. F. Motz, H. W. Eastwood and C. E. Hanna, representatives.

ELMIRA FOUNDRY CO., Elmira, N. Y.—Coremaking machine; A. Loudon, representative.

FELT & TARRANT MFG. CO., Chicago.—This concern will exhibit comptometer adding and calculating machines and demonstrations of the comptometer's application to the various kinds of figuring in foundry and metal working houses will be made; J. C. Nevins, S. C. Brown and W. D. Shimp, representatives.

GARDNER MACHINE CO., Beloit, Wis.—Grinding machines.

GOLDSCHMIDT THERMIT CO., New York City.—Demonstrations will be made of the thermit reaction and the various apparatus required for making thermit will be displayed. A full line of thermit heating cans for reviving dull iron and steel in the ladle, for making semi-steel and for keeping risers of castings liquid, also for preventing piping in steel ingots, will be shown. The following metals and alloys made by this concern, free from carbon, will be displayed: Ferro-titanium, chromium, manganese, manganese-titanium, manganese copper, manganese tin, manganese zinc, ferro-vanadium, ferro-boron and ferro-molybdenum.

GRACETON COKE CO., Graceton, Pa.—This concern will display samples of foundry coke; C. M. Lingle, representative.

GRAF MOLDING DEVICE CO., Louisville, Ky.—This concern will exhibit a roll-up hinge adapted for stove plate and other molds for light castings. A hingeless snap flask and skeleton weight will also be shown; T. H. Graf and A. N. Webb, representatives.

HANNA ENGINEERING WORKS, Chicago.—The Rathbone multiple molding machine, built by this concern, will be shown in operation, as well as a full line of pneumatic screen shakers, an electric revolving dumping riddle, electric oscillating riddle, sand blast, mold dryer and a Hanna riveter; W. L. Laib, James T. Lee and F. H. Scantlebury, representatives.

HARBISON-WALKER REFRACTORIES CO., Pittsburg.—Fire brick, silica brick, cupola blocks and refractory materials.

HAUCK MFG. CO., New York City.—This exhibit will consist of a complete line of oil burning appliances including cupola lighters, ladle heaters, core oven and furnace burners, mold driers, pre-heating and brazing outfits, etc; A. E. Hauck, A. P. Link, A. H. Stein and H. E. Giersch, representatives.

Papers to be Read Before A. F. A.

"Economical Insurance for Foundry Properties," by S. G. Walker.
"Foundry Construction," by Geo. K. Hooper.
"Vanadium Iron and Steel Castings," by G. L. Norris.
"The Foundry at Close Range," by Benj. D. Fuller.
"The Permanent Mold," by Edgar A. Custer.
"Titanium in Iron and Steel Castings," by Chas. V. Slocum.
"Production Costs," by Ellsworth M. Taylor.
"The Manufacture and Annealing of Converter Steel Castings," by Bradley Stoughton.
"The Electric Steel Furnace for Steel Castings," by Dr. P. Heroult.
"Titanium in Malleable," by C. H. Gale.
"The Practicability of the Induction Furnace for the Making of Steel Castings," by C. H. Von Baur.
"The Rotary Blower for Cupola Use," by R. H. Rice.
"Open-Hearth Steel Foundry Practice," By R. E. Bull.
"Pattern Shop Apprentice," by Jabez Nall.
"The Application of Lifting Magnets to Foundry Work," by A. C. Eastwood.
"Electric Motor Drive for Foundries," by Brent Wiley.
"The Small Open-Hearth Furnace for Steel Castings," by Walter MacGregor.
"Microscopic Structure of Iron and Steel," by Prof. William Campbell.
"Manganese and Silicon in the Foundry," by A. E. Outerbridge, Jr.
"Gas Cavities, Shot and Chilled Iron in Iron Castings," by Thos. D. West.
"Coremaking and Core Machines," by Arch M. Loudon.
"Molding Machine Practice," by E. H. Mumford.
"Machine Versus Hand Molding," by John Alexander.
"Defective Castings and How to Handle Them," by John M. Perkins.
"Core Room Practice," by F. A. Coleman.
"Cupola Melting Practice," by P. Munnoch.
"Malleable Castings," by W. P. Putnam.
"The Equipment of Air Furnaces Using Oil as Fuel," by N. W. Best.
"Phosphorus in Cast Iron," by H. E. Field.
"Mechanical Charging of Cupolas," by G. R. Brandon.
"Pattern Equipment," by W. S. Giele.
"Recovery of Foundry Waste," by S. A. Capron.
"Cupola Practice," by R. H. Palmer.
"The Foundry Foremen's Educational Movement," by F. O. Wilson.
"The Briquetting of Metal Borings and Turnings," by Dr. R. Moldenke.
Presentation of Data on the Molding Sand Tests of the American Foundrymen's Association.
Memorandum on the Standard Test Bar for Cast Iron.

Papers to be Read Before A. B. F. A.

"Alloys," by W. R. Whitney.
"Corrosion of Brass Foundry Products," by William Vaughan.
"The Pouring and Melting Points of Some High Grade Bronzes," by C. P. Karr.
"Vanadium and Its Non-Ferrous Alloys," by V. C. Lassen.
"The Pyrometer, and the Aluminum Foundry," by H. W. Gillett.
"Equilibrium Diagram," by H. W. Gillett.
"Non-Ferrous Economics—Refinements," by E. A. Barnes.
"Efficiencies of Furnaces," by Dr. J. W. Richards.
"Determination of Nickel in Alloys," by Prof. S. W. Parr.
"Analysis of Manganese Bronze," by J. R. Huber.

HAWLEY DOWN DRAFT FURNACE CO., Chicago.—The extensive line of melting furnaces manufactured by this concern will be exhibited and if suitable arrangements can be made a miniature iron foundry will be installed in one of the buildings, in which iron will be melted and molds will be cast; F. O. Bartlett, H. J. Stow, D. J. O'Brien, E. H. Schwartz and C. M. Bleyer, representatives.

HERMAN PNEUMATIC MACHINE CO., Zelienople, Pa.—Four jar-ramming molding machines will be shown in operation, including one 24 x 30-inch jar-ram stripping plate machine which rams the mold by the jarring process and draws the pattern by the use of a side lifting cylinder that engages the stripping plate and strips the mold from the pattern; two 30 x 45-inch jar-ramming molding machines equipped with roll-over and pattern-drawing device, built especially for the purpose of molding lavatories and one 60 x 60-inch plain jar-ramming machine. The molds made on this machine will be rolled over by a crane and the pattern will be drawn by hand. An overhead tramway and trolley will be especially installed for this exhibit; A. M. Frauenheim, M. L. Heyl, Charles Herman, Alfred Herman, Andrew Rogers and C. E. Pettee, representatives.

HILL & GRIFFITH CO., Cincinnati.—This booth will be fitted up with a desk and chairs where the foundrymen can meet their friends. No exhibit of foundry supplies will be made; John Hill, J. M. Glass, H. T. Taylor and Wm. Oberhelman, representatives.

IDEAL FURNACE CO., Chester, Pa.—Brass melting furnace.

INGERSOLL-RAND CO., New York City.—This exhibit will include air compressors, pneumatic chipping hammers, pneumatic sand rammers for bench and floor work, pneumatic riveting hammers, pneumatic piston and rotary drills, pneumatic motor hoists, pneumatic stationary motors, etc.; W. H. Armstrong, W. A. Armstrong, E. P. Mooney, W. B. Brendlinger, H. E. Metcalfe and J. S. Kelly, representatives.

INTERNATIONAL MOLDING MACHINE CO., Chicago.—The extensive line of molding machines maunfactured by this concern will be shown in operation and will include small and large stripping plate machines, turn-over draw machines, coremaking machines and squeezers: Edward A. Pridmore, W. W. Miller and J. W. Dopp, representatives.

INTERSTATE SAND CO., Zanesville, O.—Molding sands for iron, steel and brass foundry work.

KEYSTONE COAL & COKE CO., Pittsburg.—Foundry coke.

KILLING'S, E., MOLDING MACHINE WORKS, Davenport, Ia.—The extensive line of molding machines manufactured by this concern will be shown in operation and will include a stripping plate machine, roll-over machine, multiple cylinder plain jarring machine, two sizes of rock-over machines and an automatic squeezer; E. Killing, A. W. Fox, C. P. Aabye and Geo. Heck, representatives.

LAWLOR IMPROVED JARRING MOLDING MACHINE CO., Pittsburg.—The molding machines manufactured by this concern will be shown in operation and will include a 54 x 64-inch jarring machine, a portable combined jarring and squeezing machine with a 13 x 28-inch table plate equipped with a pattern for a 37-inch radiator: J. J. Lawlor, Edward Harmes and F. H. Zimmers, representatives.

LUPTON'S, DAVID, SONS CO., Philadelphia.—Ventilators and window sash operating devices.

McCORMICK, J. S., CO., Pittsburg.—Two continuous sand mixers with screens and an electro-magnetic separator, as well

as a full line of general foundry facings and supplies will be exhibited by this concern; J. S. McCormick, T. E. Malone, S. R. Costley and R. H. Mills, representatives.

MONARCH ENGINEERING & MFG. CO., Baltimore.—This concern will show a miscellaneous line of furnaces adapted for melting non-ferrous metals, iron, steel, etc.; H. D. Harvey and David R. Steele, representatives.

MORNER & SMITH, Dayton, O.—A line of aluminum snap flasks for use in brass and iron foundries and manufactured by this concern will be exhibited; Louis Morner and Chas. D. Smith, representatives.

MOTT SAND BLAST MFG. CO., Chicago.—This exhibit will consist of a sand blast, air compressor and painting apparatus; D. Mayer, representative.

MUMFORD MOLDING MACHINE CO., New York City.—This exhibit will include a split pattern, power-ramming molding machine with 12-inch vibrator, plain squeezer molding machine with match-plate and vibrator and 10 and 3-inch plain, jolt-ramming molding machines fitted with a new type of valve. Sections of this machine, showing in full detail the arrangement of this new valve, will also be exhibited; E. H. Mumford, Carl Falk, E. M. Huggins, F. W. Hamel and A. J. Goss, representatives.

NATIONAL CORE OIL CO., Buffalo.—Samples of various grades of core oils manufactured by this concern will be exhibited, C. H. Cotton, P. L. Crandall, C. M. Anderson, J. J. McCarty and B. J. Cummins, representatives.

NORTHERN ENGINEERING WORKS, Detroit.—This concern will exhibit an electric crane trolley of 10 tons capacity, operated by a direct-current motor. It will be exhibited in connection with a device showing dynamic braking and magnet work. This trolley is of the safety type, the gearing being entirely enclosed, all of the bearings being capped and fitted with bronze bushings, no gears being overhung. The method of enclosing and protecting the gears is unique. The trolley side frame is used as a gear case, thus economizing space. This trolley will be equipped with a dynamic braking device in place of a mechanical brake and also will be equipped with an electric brake. By the use of the dynamic braking device a large amount of mechanism is avoided and repairs are reduced to a minimum. The automatic limit stop used to prevent the block from interfering with the trolley is exceedingly simple in construction and effective in operation.

NORTON CO., Worcester, Mass.—This concern will exhibit abrasives for foundry use, including grinding wheels, oil stones, sharpening stones, alundum refractories, etc.; Geo. S. Walker, representative.

OBERMAYER, S., CO., Cincinnati.—The space reserved by this concern will be fitted up as an office; E. D. Frohman, S. T. Johnston and Mr. Carey, repersentatives.

OHIO SAND CO., Conneaut, O.—Samples of various grades of molding sands for iron, steel and brass foundry use will be exhibited; F. E. Gordon and U. E. Kanavel, representatives.

OLIVER MACHINERY CO., Grand Rapids, Mich.—A complete line of patternmaking and flaskmaking machines will be exhibited, including universal saw benches, band saws, hand jointers, surface planers, wood lathe, speed lathe, patternmakers' bench, universal tool grinders, disk sander, vertical spindle and disk sander, vertical spindle borer, wood trimmers, as well as a new style universal wood milling machine, adapted for making irregular shapes: Joseph W. Oliver, A. N. Spencer, Geo. F. Reinhard, A. S. Kurkjan, Walter Mentzer, Arthur Blake and R. A. Smith, representatives.

ORENSTEIN-ARTHUR KOPPEL CO., Pittsburg.—Narrow gage industrial railway systems.

OSBORN MFG. CO., Cleveland.—This concern will conduct an operating exhibit and the molding machines to be displayed will include plain jolt, no-lift jarring, roll-over, rock down, direct draw roll-over, rock-over, flask stripping, stripping plate, drop plate squeezing and mechanical pattern drawing molding machines; H. R. Atwater, F. D. Jacobs, E. T. Doddridge, J. H. Galloway and W. J. Halliday, representatives.

PAWLING & HARNISCHFEGER CO., Milwaukee.—This concern will exhibit traveling electric hoists, plain and geared I-beam trolleys, crane motors and controllers, in addition to a single-line grab bucket for foundry service; F. P. Breck and Geo. L. Mead, representatives.

PAXSON, J. W., CO., Philadelphia.—The booth of this company will be furnished with chairs and desk for the use of patrons and friends of this concern; H. M. Bougher, Howard Evans, W. Scott Thomas and I. F. Kremer, representatives.

PETERSON, T. J., CO., Chicago.—Samples of core oils made by this concern will be exhibited.

PICKANDS, BROWN & CO., Chicago.—This concern will make an artistic display of Solvay foundry coke; B. T. Bacon, E. A. Bateman, C. N. Turner, G. A. T. Long and J. A. Galligan, representatives.

PRIDMORE, HENRY E., Chicago.—In this exhibit will be shown stripping plate and rock-over drop molding machines, also a new electric, motor-driven jarring molding machine; R. E. Turnbull, D. E. Eagan, A. V. Magnuson and Henry A. Pridmore, representatives.

ROBINSON AUTOMATIC MACHINE CO., Detroit.—Polishing and grinding machines.

ROCKWELL FURNACE CO., New York City.—This concern will exhibit a centric spout furnace, which permits of the pouring of metal direct into molds; S. L. Barnes, F. S. Garrett, A. W. Moyer and W. S. Quigley, representatives.

SAND MIXING MACHINE CO., New York City.—This exhibit will consist of an auto sand mixer designed for cutting molding sand and for mixing core and facing sands; Wm. A. Heartt, Hutton H. Haley, John Bradley, B. F. Doup and V. E. Minich, representatives.

SELLERS, WM., & CO., INC., Philadelphia.—This concern will show, in operation, the following motor-driven machines: Centrifugal sand mixing machine, drill grinding machine and a universal tool grinding and shaping machine; Edward L. Holljes, representative.

SHEPARD ELECTRIC CRANE & HOIST CO., Montour Falls, N. Y.—In this space will be exhibited a crane trolley and crane cage and a back-geared electric motor and cage controlled mono-rail electric hoist. Two or three small foundry hoists will also be shown in operation in connection with the exhibits of several manufacturers of molding machines.

SLY, W. W., MFG. CO., Cleveland.—This exhibit will consist of a miniature line of tumbling mills with dust arrester, as well as sand blast machinery, cleaning room equipment, etc., which will be shown in operation; W. W. Sly, W. C. Sly, Geo. J. Fanner, H. R. Morse and H. J. Norris, representatives.

STANDARD LINSEED CO., Cleveland.—Cores made with core oil manufactured by this concern will be exhibited, as well as samples of their product; N. Weisenberg, A. C. Bernsteen and H. G. Tremmel, representatives.

STANDARD SAND & MACHINE CO., Cleveland.—Sand grinding, mixing, tempering and blending machines.

STERLING WHEELBARROW CO., West Allis, Wis.—A complete line of rolled steel foundry flasks will be shown; I. R. Smith and John L. Kirk, representatives.

STEVENS, FREDERIC B., Detroit.—Foundry supplies.

SUPERIOR SAND CO., Cleveland.—A full line of molding sands will be displayed including sand for the production of ingot molds, heavy machinery, heavy malleable, medium malleable, gray iron castings, stove plate, light gray iron and malleable, brass and aluminum castings; W. H. Smith and H. C. Koontz, representatives.

TABOR MFG. CO., Philadelphia.—In this operating exhibit will be displayed plain power squeezers of various sizes, power squeezing split pattern molding machines, hand and power roll-over molding machines, shockless jarring machines, combined shockless jarring and roll-over machines, combined jarring and squeezing roll-over machines, as well as the Taylor Newbold saw, Taylor-Newbold inserted blade milling cutters and the Taylor universal tool grinder; Wilfred Lewis, H. W. Brown, John T. Ramsden, C. W. Coleman, J. H. Coleman, C. H. Ellis and Glen B. Hastings, representatives, and John Pfender, Dudley Willcox, H. W. Impey and D. J. Martin, demonstrators.

TATE, JONES & CO., INC., Pittsburg.—This exhibit will consist of a stationary brass melting furnace, oil pumping, heating and regulating system, portable oil burners for cupolas, lighting and ladle drying, and oil and gas burners; J. M. Tate, Jr., R. G. Kirkwood, E. E. Rushton and J. C. Whitfield, representatives.

VANADIUM SALES CO. OF AMERICA, Pittsburg.—This concern will exhibit a number of vanadium cast iron and wrought steel test specimens, as well as a vanadium cast steel yoke, vanadium cast steel and vanadium cast iron cylinders.

WESTINGHOUSE ELECTRIC & MFG. CO., Pittsburg.—This concern will exhibit several types of motors and controlling devices and for the first time will show a new style starting and stopping rheostat. The resistance on this rheostat is embedded in an insulating compound which thoroughly protects the resistance from coming into contact with the air and thereby permitting the moisture to corrode the resistance wire. This rheostat is particularly well adapted for foundry service, where, on account of atmospheric conditions, extra precautions must be taken; B. Wiley, F. H. Herzsch, J. H. Klinck, E. M. Wise, W. B. Wilkinson and E. D. Townsend, representatives.

WHITING FOUNDRY EQUIPMENT CO., Harvey, Ill.—This exhibit will include spur geared crane ladles, worm geared truck ladles, exhaust tumblers, turntable for yard tracks, etc.; C. A. Hardy, R. H. Bourne and T. S. Hammond, representatives.

WISE, J. B., Watertown, N. Y.—The metal melting furnaces manufactured by this concern will be shown in operation including one 150-pound, one 250-pound and one 450-pound M. R. V. furnace; R. F. Goyne and R. J. Ryan, representatives.

YALE & TOWNE MFG. CO., New York City.—Hoists for foundry use.

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Some Unsolved Problems in Electroplating*

THERE has existed for such a long time a separation of the practical plater and the electrochemist that it is a pleasure to present this paper, and it is hoped that the practical end of electroplating, as represented by the National Electroplaters' Association, and the scientific end as represented by this society, will be brought into a closer relation. As is well known, electroplating was the beginning of the science of electro-chemistry, but it has lingered by the wayside and been neglected as a science, and today the unsolved problems are many.

Electroplating has been looked upon more as a trade than a science, and it is only during recent years that much study has been given to it by scientists, and that attention has been directed more to the electrolytic refining of metals than to the disposition of metal for decorative purposes. The solutions published by Roseleur in 1854 have been improved upon but little, and those who have published treatises upon the subject often give only a repetition of his formulas. Nickel-plating, as invented by Dr. I. Adams, is probably the only exception.

Electro-Chemist in the Plating Room.

The field is broad, but its development has been left to the practical man, guided only by rule of the thumb. Electro-chemists in the plating rooms of factories are so rare that it probably can be said without fear of contradiction that they can be counted on the fingers of one's hands. The need today is mutual assistance in solving these problems and developing of new ideas. To a great extent they are *useless each without the other* —the plater producing results which he cannot duplicate—the electro-chemist creating solutions that are not a commercial success.

So many phenomena have been encountered that to include the perplexing problems would necessitate a history of nearly every known solution and finish. The varying of the temperature and the electric current often prove a stumbling block, and these conditions cannot always be controlled. There is a vast difference between producing a homogeneous deposit at a minimum cost from a solution where the amount of cathode surface is being changed every 20 minutes, and a solution in which the amount of cathode surface is always the same and the rapid deposit of the metal is more desired than a deposit that can be easily burnished. Such would be the difference, for instance, between the surface of a sheet of electrolytic copper and that of a cast lead and antimony electrolier with its deep reliefs and where a coarse crystalline structure would destroy its beauty. In the discussion of electroplating problems, it must be borne in mind that a mere deposit of a metal is not all, but that the deposit must be soft and smooth and lend itself to a decorative process; the anodes should be capable of being reduced easily: the electrolyte must offer little resistance to the electric current, and, last, but not least to the plater, who hears it so often that it becomes a part of him, the cost must be nominal.

*Read at the New York meeting of the American Electro-Chemical Society.

Plating Castings.

The automobile industry has brought about, more than anything else, the need of a heavy deposit of brass. At present this is done in a solution of cyanide of copper. The deposit is not only slow, but unsatisfactory, because of what is known as *spotting out*—a discoloration in spots which appears on the work after it has been polished and lacquered. Deposits on cast metal give the most trouble. It is probably caused by the acids or alkaline solutions being absorbed in the pores of the metal, or in the small blow-holes, and the deposit covering these holes partially, leaving minute holes through which the solution oozes out. Several remedies have been suggested and tried, such as boiling out in some neutralizing chemical solution, placing in a drying oven for several days, but a satisfactory remedy has not been found.

Acid Brass Solution.

An acid brass solution would be a great advantage. There is an acid copper and an acid zinc solution, but no acid brass electrolyte. The difference between the deposit from a cyanide and a sulphate of copper solution well illustrates the advantage of having an acid brass solution.

Tin.

The formula for a tin solution published by Roseleur is the most generally used today, as little, if any, improvement has been made upon it, although a good solution which would give a heavy deposit is much desired. In Roseleur's solution the electrolyte is not replenished by the anode, but by the constant addition of a concentrated solution. This should be overcome, and would be appreciated by manufacturers of tinware.

Aluminum.

While several solutions have appeared from time to time for plating upon this metal, none of them is in general use, and a good electrolyte that would deposit gold, silver, brass or copper so that it would stand burnishing and not peel off in time could be used.

Nickel.

The successful removal of a deposit of nickel from another metal without affecting the latter has not been accomplished.

Unsolved Problems.

To give all the unsolved problems in detail would make a lengthy paper and a simple statement of those most desired will be given:

An electrolyte that will remove the fire-scale from brass; also one that will produce a bright or a matte surface in place of using the present acid dips.

An electric cleaner that will saponify the grease and take it into solution instead of driving it to the top, where it has to be constantly removed to prevent it adhering again to the work as the latter is removed from the solution.

A heavy deposit of lead on the inside of iron pipes, to prevent rapid corrosion.

A method to coat electro-galvanized iron or steel with decorative metals without destroying the rust-resisting properties of the zinc.

An alkaline nickel-silver solution that can be worked with a low voltage.

A method of etching steel without destroying a resistance film of gelatine.

Some alkaline substance that would replace cyanide of potassium. This would be universally welcomed.

For the above suggestions, the writer is indebted to 100 different platers, who were kind enough to answer a request for unsolved problems. It may be interesting to note that 80 per cent of them requested an acid brass solution.

The autumn meeting of the Institute of Metals will be held at Newcastle-on-Tyne, England, Wednesday and Thursday, Sept. 20 and 21. A local committee, of which Hon. C. A. Parsons is chairman and Dr. J. T. Dunn secretary, has been formed to make arrangements for the convention.

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Trade Outlook

The 50-cent reduction in the price of iron ore has had no effect on pig iron quotations and it is doubtful whether foundry iron buyers will be benefited by this decline in the cost of raw material, as present quotations practically represent the cost of iron manufacture, based on this year's ore values. The improvement noted in the foundry trade last month has not been maintained, although there has been no decline in the demand for brass castings. The operations of foundries specializing in railroad work, particularly steel and malleable, are still below normal and the output of these shops will be curtailed until the railroads countermand their retrenchment program. Notwithstanding trade conditions, many foundrymen are making extensions to their plants and new projects are being undertaken in all sections of the country that will further increase foundry capacity. In the leading centers, No. 2 foundry iron is quoted as follows: Pittsburg, $14.65; Chicago, $15; Cleveland, $14.25; Cincinnati, $15.20; New York, $15.50; Philadelphia, $15.50; Buffalo, $13.75, and Birmingham, $11. At Chicago, Lake Superior charcoal is quoted at $17.50 and basic iron is held at $14.90, Pittsburg, and $15, Philadelphia. Both lake and electrolytic copper have declined, being offered at 12.37½ cents and 12.25 cents, delivered, respectively. Lead is quiet and is quoted at 4.50 cents, New York, and spelter is practically unchanged at 5.50 cents, New York. Antimony is quoted as follows, New York: Cookson's, 9.50 cents; Hallett's, 8.87½ cents, and Hungarian, 8.50 cents.

The Association Movement Among Foundrymen

That the growth of the association movement among foundrymen has more than kept pace with the wonderful development of the industry, in the last decade, should prove a source of gratification to those who have labored untiringly to advance the art of founding. For the second time in the history of the American Foundrymen's Association, Pittsburg will again entertain the members of this organization. Twelve years ago, not more than 100 foundrymen attended the third meeting of this society in the Smoky City. It was an enthusiastic gathering, thoroughly representative of the industry yet the most optimistic would not have ventured the prediction that several thousand foundrymen would be present in Pittsburg at the time of the next gathering in that city, members not only of the parent body, but of several allied organizations, whose sole aim and purpose is the advancement of foundry practice. The association movement has gone forward steadily, through periods of depression and prosperity, gathering momentum until every branch of the foundry trade is represented by one of the several organizations. In recent years, this great educational work among foundrymen has been fostered and advanced by the manufacturers of labor-saving machinery and equipment and these exhibits now constitute one of the most interesting features of these gatherings. At Pittsburg, this display will be continued for a period of ten days to enable the members of the American Society of Mechanical Engineers to witness the demonstrations of foundry tools. The summer meeting of this organization follows the foundrymen's convention, and while the show has been extended ostensibly for the purpose of permitting the attendance of the engineers, it will afford many foundrymen an opportunity of witnessing the show, particularly those who find it inconvenient to be in Pittsburg at the time of the foundrymen's meeting. That the problem of economical molding methods is of foremost importance to foundry operators is reflected by the large number of new molding devices which will be shown at Pittsburg for the first time. Melting is also receiving the attention it justly deserves and a number of important papers on this subject are to be presented.

Personal

U. E. Kanavel of Cleveland, who has been affiliated with the molding sand business of the central west for many years, is now connected with the Ohio Sand Co., Conneaut, O.

W. V. Knauss, treasurer of the Bethlehem Foundry & Machine Co., South Bethlehem, Pa., has resigned and has been succeeded by I. E. Krause.

D. P. Chase, formerly superintendent of the New York Car Wheel Co., Buffalo, has resigned and has been appointed secretary of the Albany Car Wheel Co., Albany, N. Y.

T. P. Kelly, of T. P. Kelly & Co., New York City, will sail for Europe on June 28 on the White Star Liner Olympic. Mr. Kelly expects to be abroad about two months.

Chas. J. Caley, works manager of the Peterborough Lock Mfg. Co., Ltd., Peterborough, Canada, has severed his connection with that concern and his present address is 116 Newhall street, New Haven, Conn.

James R. Mansfield, superintendent of the Bay State Brass Co.'s foundry, Haydenville, Mass., has resigned, and Irving S. DeRochement, of New Ha-

ven, Conn., has been appointed his successor.

R. N. Palmer has resigned as instructor in foundry practice at the Worcester Polytechnic Institute, Worcester, Mass., to become foundry superintendent of the Buckeye Engine Co., Salem, O.

Joseph F. H. Dixon, formerly secretary and general manager of the Federal Steel Foundry, has been appointed general manager of the Keystone Steel Casting Co., Chester, Pa., succeeding R. B. Farquhar Jr.

W. L. Abate has resigned as general superintendent of the Nathan Mfg. Co., New York City, and has taken charge of the various brass foundries operated by the Standard Sanitary Mfg. Co. Mr. Abate will make his headquarters at Louisville, Ky.

Obituary

Mortimer Horning Bickley, one of the founders of the Penn Steel Casting Co., Chester, Pa., and its president since its formation in 1892, died at his home in Chester on April 8, aged 79 years. Mr. Bickley was born in Montgomery county, Pa., educated in the public schools and later became a drug clerk. In 1854 he graduated from the Philadelphia College of Pharmacy and two years later entered into partnership in the drug business under the firm name of Allen & Bickley. In 1892 Mr. Bickley organized the Penn Steel Casting Co. and established a plant at Front and Penn streets, Chester, for the manufacture of open-hearth steel castings and under his able management the Penn works became one of the largest steel casting plants in the eastern section of the state. Mr. Bickley was married twice and is survived by his second wife and two sons and a daughter by his former marriage. One of the sons, Walter Scott Bickley, has for a number of years been superintendent of the works of the Penn Steel Casting Co.

Henry Cribben, president of the Cribben & Sexton Co., Chicago, died April 6, aged 77 years. He was born in the Isle of Man, but was brought to this country when a child, his parents locating at Rochester, N. Y. At the age of nine years he was left an orphan, but was cared for by friends until he was 16 years old, when he became a molder's apprentice. At the outbreak of the civil war he enlisted and served in the army until discharged in 1865. Returning to Rochester he organized the Co-operative Foundry Co., which engaged in the manufacture of stoves, and became its manager, later opening a branch in Chicago which he eventually purchased and incorporated as the Cribben & Sexton Co., the presidency of which he held until his death. Mr. Cribben took an active interest in the associations formed for the promotion of the stove trade. He served a term as president of the National Association of Stove Manufacturers and was for 10 years president of the Stove Founders' National Defense Association. He is survived by a widow, a daughter and two sons.

Ludwig Wolff, president of the L. Wolff Mfg. Co., Chicago, manufacturer of plumbers' supplies, died April 14, after a protracted illness, at his home

MORTIMER HORNING BICKLEY

in that city, aged 75 years. At the age of 18 he came to this country from Germany, with his parents, and for a time met with much ill fortune, but eventually established himself in a small way as a coppersmith, borrowing much of the necessary material. He was awarded a contract by the Chicago & Northwestern railroad to supply bent tubes for locomotives. The order was obtained after he had demonstrated to the officials how this could be done. The business grew rapidly and in 1866 Mr. Wolff purchased the interest of his partner, Terrence Maguire, and later organized the L. Wolff Mfg. Co. He is survived by five sons and one daughter.

John P. Hughes, vice president of the Chicago Foundry Foremens' Association and superintendent of the foundry of the Allis-Chalmers Co., Chicago, died April 7, at St. Joseph's Hospital, where he had undergone an operation for appendicitis.

Book Reviews

Metal Work and Etching, by John D. Adams, 88, 4½ x 6¾ pages, illustrated, published by *Popular Mechanics*; price 25 cents.

This little book is intended for the instruction of amateurs in art metal work, and is written in an interesting non-technical manner, with copious illustrations of designs and details of the manufacture of sheet metal novelties in copper and brass. The main idea of the book is to develop the originality of the amateur worker in this fascinating art, and to this end every encouragement is given, and the way is clearly pointed by the many suggestions it contains regarding the making of such desirable little novelties as desk sets, paper knives, candlesticks, match boxes and art crafts jewelery.

Cambria County Pioneers, by James M. Swank, general manager of the American Iron and Steel Association; 138 pages, 9½ x 6¼ inches. Furnished by THE FOUNDRY for $2.50, postpaid.

This work is a compilation entirely, with two exceptions, of 200 biographical and other sketches relating to Cambria county, Pa., that were written some years ago. In his preface Mr. Swank states that he has compiled these sketches not only to preserve the memory of prominent and worthy citizens of Cambria county, who have had much to do with its early history, but to preserve historical facts of local interest which otherwise might be wholly lost, some of which are interwoven with those of a purely personal character. Attention is called to the fact that Johnstown was a shipping point of interest on the Conemaugh river long before the Pennsylvania canal or the Pennsylvania railroad were thought of, and that there were many iron enterprises at and near Johnstown, even before the Cambria Iron Works were built. An exceedingly interesting chapter is devoted to the building of the Cambria Iron Works, and the tribute to John Fritz by Mr. Swank at the dinner to Mr. Fritz on Nov. 17, 1910, by the manufacturers of Philadelphia, is also included.

The fourteenth annual meeting of the American Society for Testing Materials will be held at the Hotel Traymore, Atlantic City, June 27 to July 1. The program for this meeting is now in an advanced state of preparation, and owing to the improved financial condition of the society, papers and committee reports, in so far as possible, will be printed and circulated in advance of the meeting.

FOUNDRY and PATTERN SHOP EQUIPMENT

Combination jar-ramming and squeezing molding machine---Roll-over core machine--Sand mixer--Aluminum snap flask--Turn-over draw molding machine---Bench core machine---Flask support

A PORTABLE, combined jar-ramming and squeezing molding machine, built by the Lawlor Improved Jarring Molding Machine Co., 950 Century building, Pittsburg, is shown in the accompanying illustrations. This machine is adapted for making molds for light castings, such as are made in snap flasks, and by moving aside the squeezing head, the machine can be used as a plain jar-rammer for making deep molds. This molding machine can, therefore, be used for jar-ramming and squeezing molds, as a plain squeezer or as a jar-ramming and stripping plate machine.

As shown in Figs. 1 and 2, the machine is mounted on a timber foundation, a resilient material being placed between the timbers to dissipate the shock. A truck, mounted on four wheels, encircles the entire foundation, which is raised and lowered through the inside of the truck. The machine can be operated on a track or on the foundry floor, as desired, the machine and foundations being raised and lowered by a lever through toggles which impose the weight of the machine onto the truck when the machine is to be moved, or permit the foundation to rest on the foundry floor when the machine is to be operated. In Fig. 6, the operator has raised the foundation of the machine from the foundry floor by the toggle-actuating lever.

The jar-ramming mechanism is similar in construction to that of the plain jarring machine, made by this concern, but the table is smaller and the lifting capacity is less. A steel post, which carries the squeezing cylinder, sets in a recess in the base of the machine and is also clamped in position above this recess and to the base of the jarring machine. The squeezing head consists of a double-acting air cylinder, 11 inches in diameter, and can be raised or lowered to conform to the depth of the flask on the table of the machine. The head is mounted on ball bearings to permit of its easy movement around the steel post.

In Fig. 1, a pattern for a 37-inch radiator is shown mounted on the table before the flask has been set in position. The squeezing head has been swung aside to permit the operator to fill the flask with sand and to jar-ram the mold. In this illustration, the squeezing board has not been attached to the plate of the squeezing cylinder. After jar-ramming the mold, the squeezing head is swung into position over the flask, as shown in Fig. 2, to finish ramming the mold. It is customary to butt-ram by hand, molds made on jarring machines, but this hand work is eliminated by the use of the squeezing head. In Fig. 2, it will be noted, the squeezing plate has been slotted to conform to the bars in the flask, and these plates can be made of any size or form to meet the requirements of the flask used. After the mold has been jar-rammed, as shown, air is admitted to the squeezing cylinder, thereby lowering the squeezing plate and which finishes the ramming of the mold. In Fig. 3, the squeezing plate and board are shown lowered, immediately after squeezing the mold. The squeezing plate is raised and to permit of the removal of the mold, the squeezing head is swung aside, as shown in Fig. 4. In this view the flask-stripping mechanism is also shown in the position it assumes when lifting the

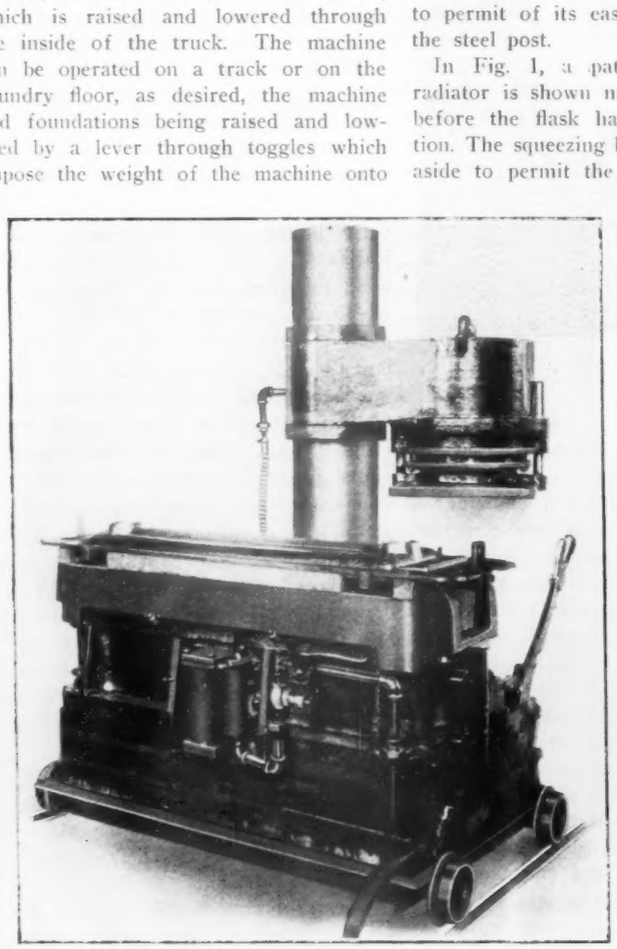


FIG. 1—COMBINATION JAR-RAMMING AND SQUEEZER MOLDING MACHINE, SHOWING PATTERN IN PLACE TO RECEIVE THE FLASK

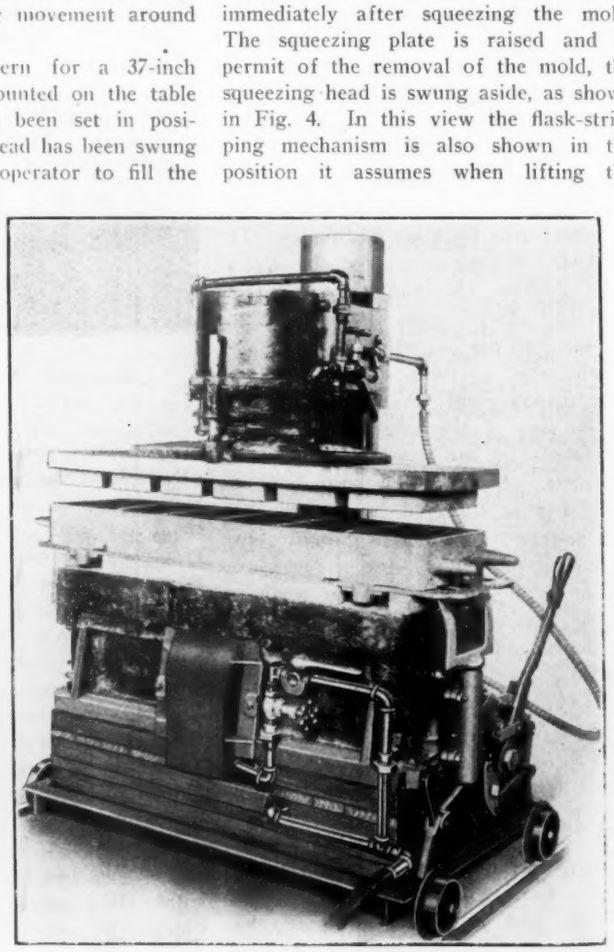


FIG. 2—MOLD AFTER RAMMING, SHOWING SQUEEZING HEAD IN POSITION FOR SQUEEZING THE MOLD AFTER JARRING

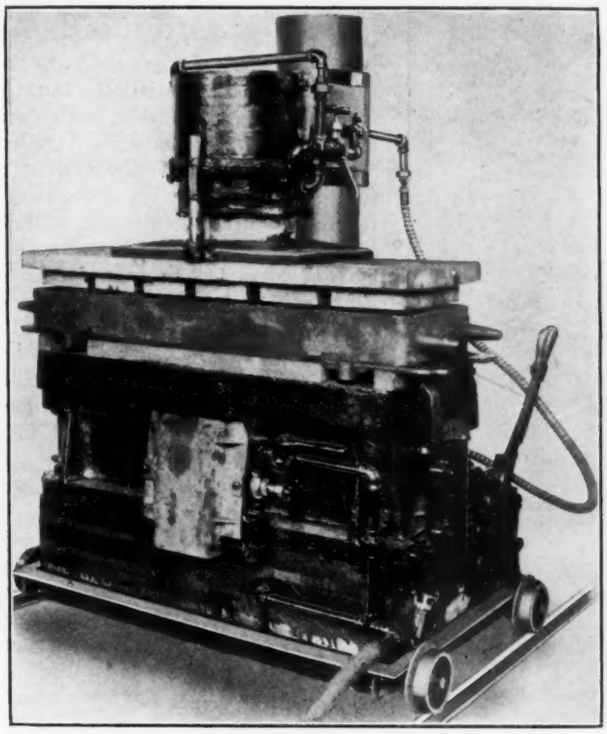


FIG. 3—SQUEEZING PLATE AND BOARD IN LOWERED POSITION JUST AFTER SQUEEZING THE MOLD

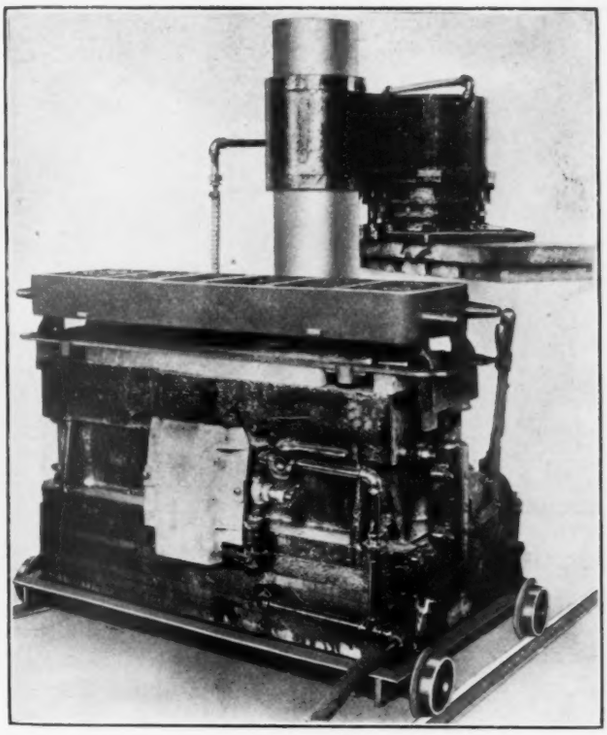


FIG. 4—SQUEEZER HEAD SWUNG ASIDE AND MOLD STRIPPED AWAY FROM THE PATTERN

mold away from the pattern. The flask is engaged at two points at either end, as shown, and for light work this flask-stripping mechanism is actuated by hand, while for heavy work it is operated by compressed air.

The plain, Lawlor jar-ramming machine, mounted on a timber base, set on a concrete foundation, is illustrated in Fig. 7. It consists, essentially, of only two parts, the table plate and base castings, shown in Fig. 8. It will be noted that the machine is extremely low, the combined height of the table and base or anvil varying from 12 to 22 inches, according to the capacity of the machine. In Fig. 8, the base casting is shown at *A*, and the table inverted, cast integral with the plunger, is illustrated at *B*. It will be noted that there are 16 contact points on the base and table and these have been located at points as far away from the cylinder as possible to overcome the overhang of the table. At the outside corners of the table there are four guides which are turned at the same setting when the plunger is machined, thereby insuring accurate alignment. Both table and base are well-ribbed, containing from 16 to 20 ribs, according to the size of the machine. This construction, with practically no table overhang, practically eliminates all vibration. The valve, which is of the differential piston type, is attached to the base, as shown in Fig. 1, the valve cover being removed in this illustration. The valve is exceedingly simple in construction and consists of

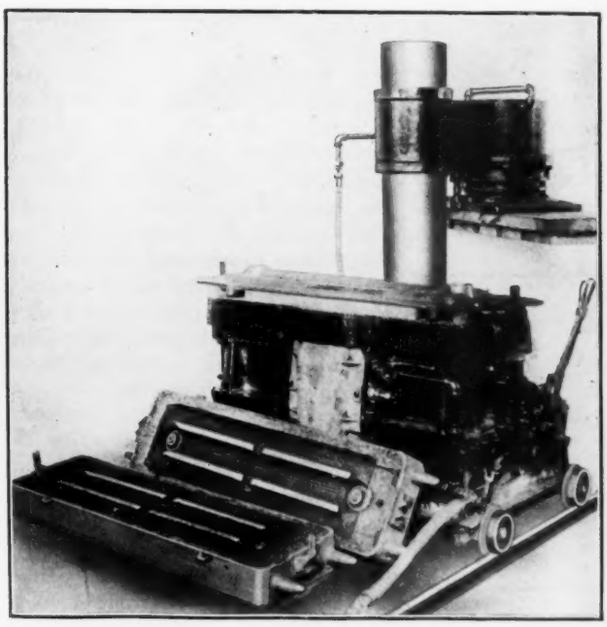


FIG. 5—THE COMPLETED RADIATOR MOLD

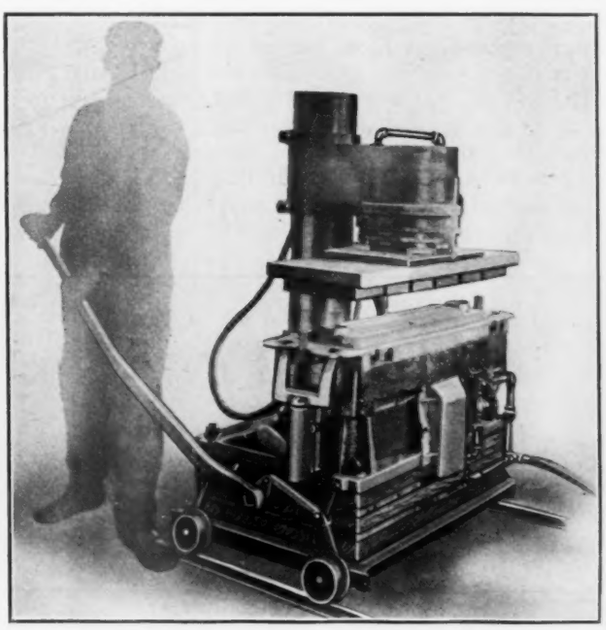


FIG. 6—METHOD OF RAISING AND LOWERING MACHINE THROUGH THE TRUCK BY WHICH IT IS SUPPORTED

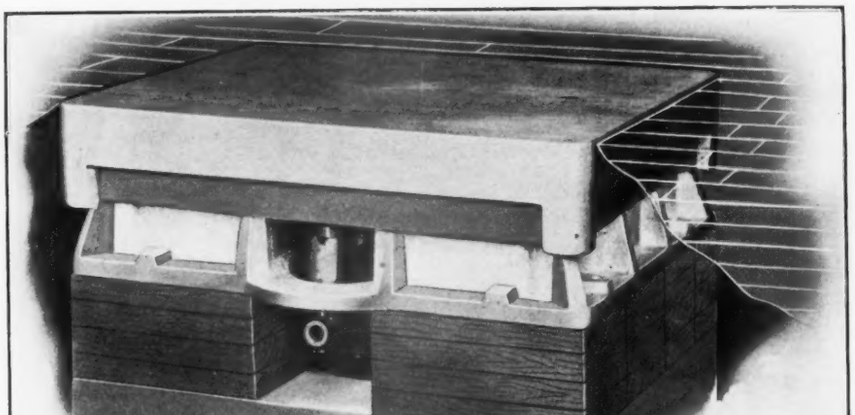


FIG. 7—LAWLOR JAR-RAMMING MOLDING MACHINE

only two parts and the body, as shown in the cross-section of the machine, Fig. 9. The valve has no connection with the table and any stroke can be obtained from ¾ to 2½ inches. The blow can be varied through the throttle valve, while the machine is in operation, by increasing or decreasing the air supply. The valve is entirely enclosed and is constantly flooded with oil. The machine is operated at air pressures from 60 to 80 pounds and is built in seven sizes, with table plates from 26 x 32 inches to 96 x 144 inches, for jarring molds from 2,000 to 50,000 pounds in weight.

Welfare Work of Molders' Union

The quarterly report recently issued by R. H. Metcalf, financier of the International Molders' Union of North America, shows that during 1910, 6,463 members were initiated, an average of 538 per month, and the total reinstatements totaled 7,218. During this period the union paid $146,110.40 to its sick and disabled members and had a greater balance to its credit at the close of 1910 than at any previous time in the history of the organization.

The out-of-work feature of the union reflects foundry trade conditions which have existed since the first of the year. During 1910, local unions received 29,580 out-of-work stamps from the headquarters of the organization, whereas during January, February and March of this year, 24,345 stamps had been issued, showing that in the first quarter of this year the number of stamps sent to locals were only 5,235 less than were issued during the entire 12 months of last year. These stamps are issued for the payment of dues of those who cannot secure employment and this feature permits these members to remain in good standing and also entitles them to other benefits of the organization. During the first quarter of this year, notwithstanding adverse trade conditions, 1,087 members were initiated and 928 were reinstated. The jurisdiction controversy between the metal polishers and the International Molders' Union over the brass molders has been ended and during the first quarter of this year 408 members, who were formerly affiliated with the metal polishers, have transferred their memberships to the molders' union and henceforth no brass molder or coremaker will be permitted to join the metal polishers.

Sick benefits paid during January, February and March reached the enormous total of $45,327.60, whereas the collections amounted to $40,632.42, showing an excess of disbursements over receipts of $4,695.18. During this quarterly period, however, the sick benefits always exceed those of any other period during the year and this deficit will be easily overcome during the next quarter. Since January, 1896, when the sick benefit feature was inaugurated, a total of $1,916,076.45 was paid to the members of the International Molders' Union from this fund. In addition to the sick benefit feature, which is now well-established, it is the intention of the union to inaugurate a mutual insurance plan, but thus far, the efforts in this direction have been handicapped by trade conditions as applications for insurance cannot be obtained from members who are out of work. Ultimately, the insurance feature promises to be an important part of the welfare work conducted by this organization.

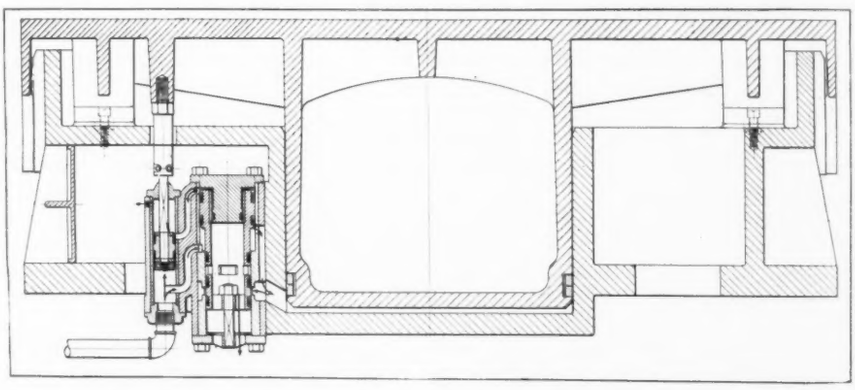


FIG. 9—CROSS-SECTION OF JAR-RAMMING MOLDING MACHINE

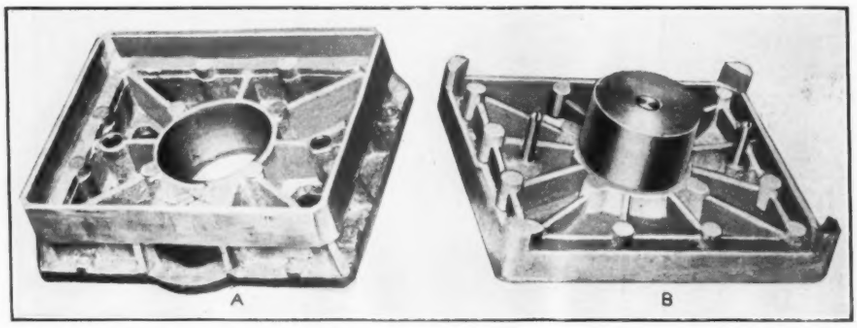


FIG. 8—BASE AND TABLE PLATE OF JAR-RAMMING MACHINE ARE SHOWN RESPECTIVELY AT *A* AND *B*

Frederic B. Stevens, Detroit, manufacturer of foundry supplies and equipment, has recently installed injector sand blast systems in the Sherwood Brass Works and the plant of the Universal Motor Truck Co., Detroit, as well as in the foundry of the Bunting Brass & Bronze Co., Toledo.

Jolt-Ramming, Roll-Over Core Machine

In the accompanying illustrations is shown a jolt-ramming, roll-over core machine, manufactured by the Midland Machine Co., Detroit. This machine is designed for making cores of irregular shape and size, and is also adapted for making small molds. The sand is rammed in the flask or core box, by jar-ramming, this operation being performed mechanically by the foot lever shown. In Fig. 1, the machine is shown adapted for molding a small, air-cooled cylinder, which is mounted on a plate and fastened to the rotating table of the machine. At the foot of the machine is a half mold of this cylinder, which was jolt-rammed on the machine,

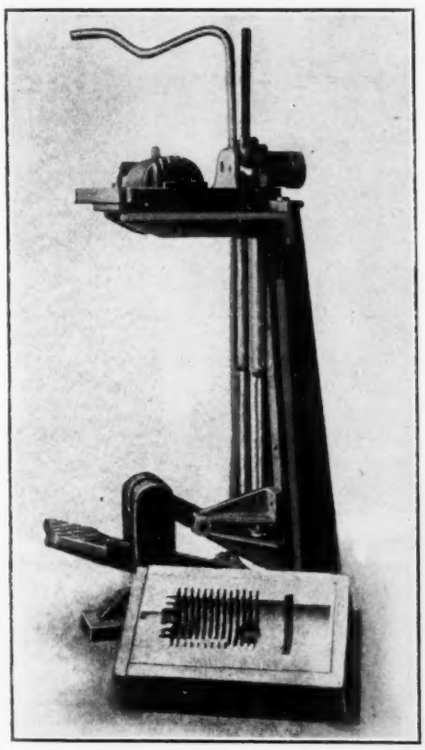


FIG. 1—JOLT-RAMMING CORE MACHINE, FITTED FOR MOLDING A SMALL, AIR-COOLED CYLINDER

and the pattern was drawn without the use of wires to hold the ribs. The various operations involved in making a mold or core are shown in sequence by the illustrations. The core box or flask is first adjusted on the table of the machine. It is then filled with sand, and if wires are required they are bedded-in place, and the mold or core is then jolted a few times by means of the foot-operated lever shown. The mold or core is then given a superficial butt-ramming, and the bottom board or core plate is bedded-on and securely clamped by the curved lever, shown in Fig. 2. The mold is then ready to roll-

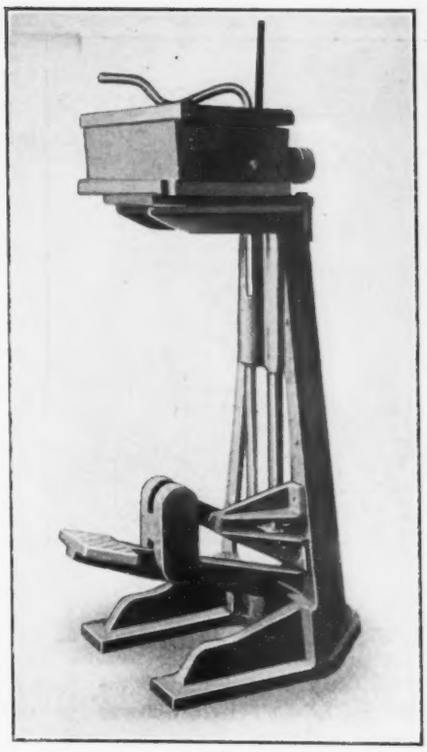


FIG. 2—JOLT-RAMMING CORE MACHINE, SHOWING THE MOLD CLAMPED, READY TO ROLL-OVER

over, which is accomplished by depressing the foot lever, thereby raising the table carrying the core box or flask, so that it can clear the two outstanding

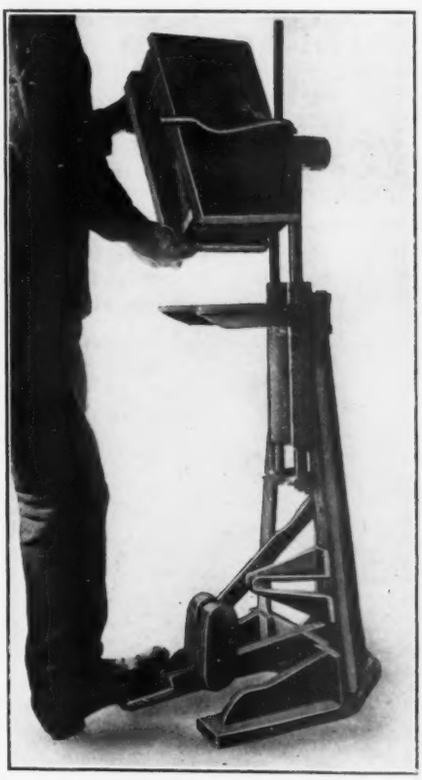


FIG. 3—ROLLING A MOLD OVER ON THE JOLT-RAMMING CORE MACHINE

arms, situated underneath the table. The mold or core box is then rotated, as shown in Fig. 3, and is lowered onto the receiving arms and the clamp being loosened, the core box or pattern is withdrawn upwards by depressing the foot lever, which raises the table to which the core box or pattern is attached. In Fig. 4, the table is shown holding a core box which has been lifted away from the core, the latter being supported on a core plate held by the receiving arms. For long work the arms can be swung out of the way and the core box turned without raising the table.

The machine has three bars attached at the top and bottom, which form the sliding guides. The top connection be-

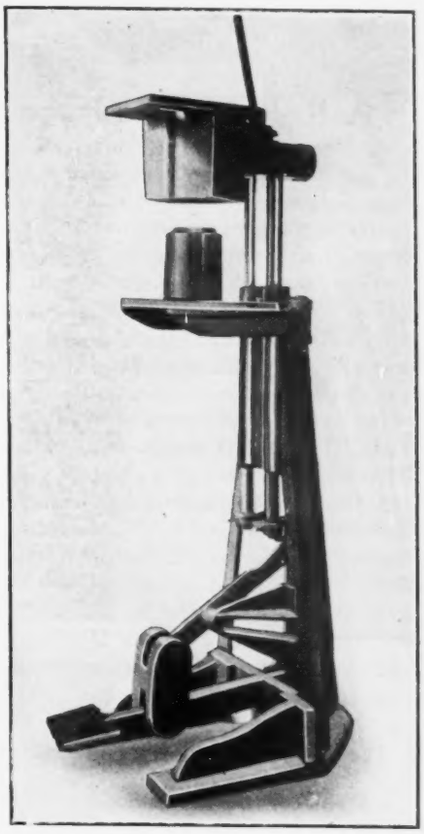
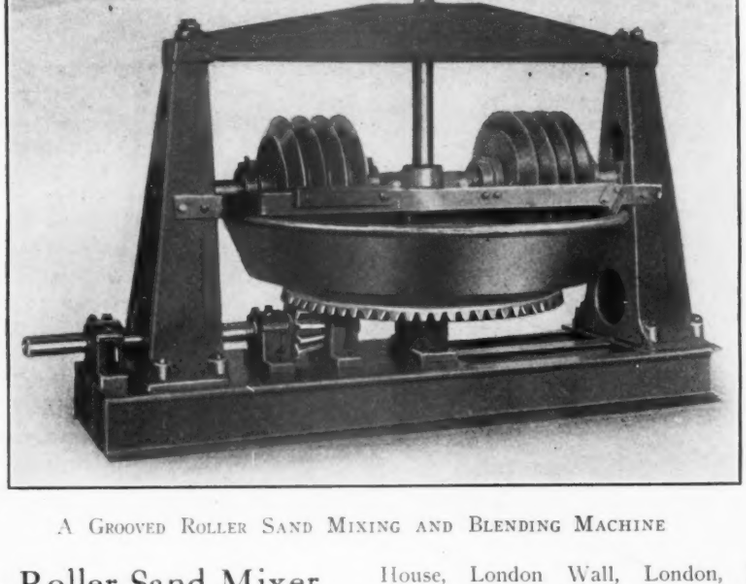


FIG. 4—THE CORE BOX LIFTED AWAY FROM THE CORE ON THE JOLT-RAMMING CORE MACHINE

tween these bars forms the bearing for the long trunnion of the revolving table. For small, light work, the clamp can be taken off and the plate held in place by hand, while the core or mold is rolled-over. The operating cam or lever is counterweighted, which makes the machine easy to work, and as the mechanism is manipulated by foot power, the machine can be operated rapidly. The machine is built in two sizes, and has a life of 10 inches, which permits it to handle a wide range of work, both in molding and coremaking.



A Grooved Roller Sand Mixing and Blending Machine

A Roller Sand Mixer

A grooved roller sand mixer adapted for mixing and blending molding sand for steel foundry use, is shown in the accompanying illustration. The frame consists of two cast iron, box section standards bolted to 8-inch I-beams and at the top of the standards a yoke is attached, thereby insuring a rigid construction. The grinding pan is made of cast iron and is provided with a renewable chilled iron liner. The rollers are made of chilled iron and have four grooves each. All operating parts are amply protected from the sand and are designed to insure easy accessibility for lubrication. The rubbing action of the grooved rolls insures a mixture of the sand, clay and binder which will vent easily, thereby insuring the escape of the gases.

The Sullivan Machinery Co., Chicago, has established an office at 814 Salisbury House, London Wall, London, Eng. Howard T. Walsh, for several years Pacific coast manager of the Sullivan Machinery Co., is in charge of this office and has associated with him Arthur F. Belding, formerly connected with the Joplin, Mo., office of this concern.

Aluminum Snap Flask

An aluminum snap flask, manufactured by the Morner & Smith Pattern Works, Dayton, O., is shown in the accompanying illustrations. The closed flask is shown in Fig. 1 and it will be noted that it is reinforced by perpendicular and horizontal ribs, which insure great strength. The interior of the flask is absolutely smooth and is properly tapered. In Fig. 2 the cope half of the flask is shown in an upright position on the drag flask. This view illustrates the mechanism of the twin sand strips in the cope. These are so constructed that they cannot become clogged with sand or stick when the operating levers are pressed by the molder in removing the flask from the finished mold. By depressing the lever when grasping the flask, the sand strips are thrown outward at an angle of 45 degrees, thereby releasing the flask from the mold. The flask is equipped with adjustable V-pins, having large bearing surfaces. The flask is exceedingly light and can be readily handled by the molder.

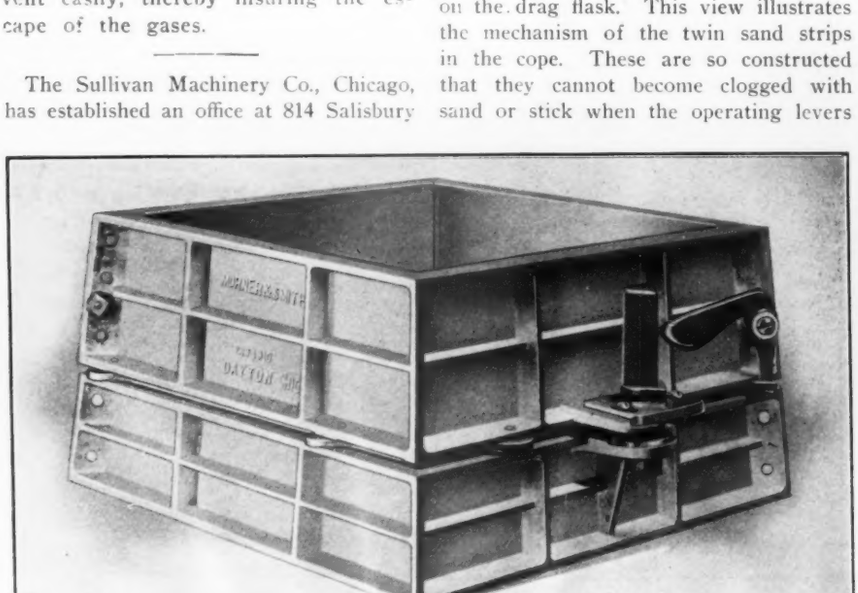


Fig. 1—Solid Aluminum Snap Flask, Showing the Pattern Plate in Position

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Riddle and Sand Mixer

A combination riddle and sand mixer, built by the J. S. McCormick Co., Pittsburg, is shown in the accompanying illustration. The rotary riddle is mounted above the sand mixing hopper and the sand, after passing from the screen, is carried on a conveyor to a hopper at one end of the frame, from which it falls into the revolving drum. The revolving screen is substantially constructed and after the wire has become worn, it can readily be replaced. The

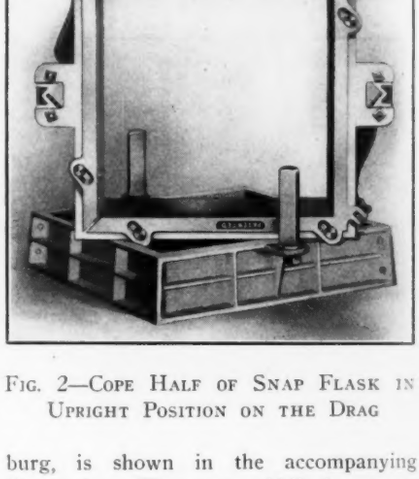
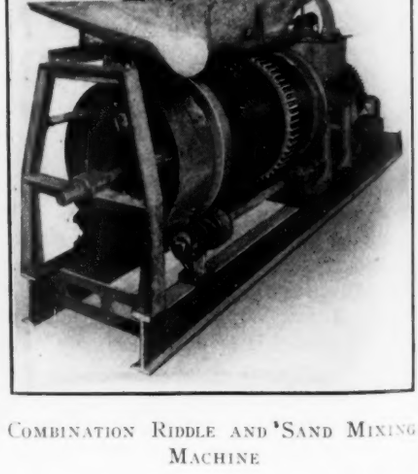


Fig. 2—Cope Half of Snap Flask in Upright Position on the Drag

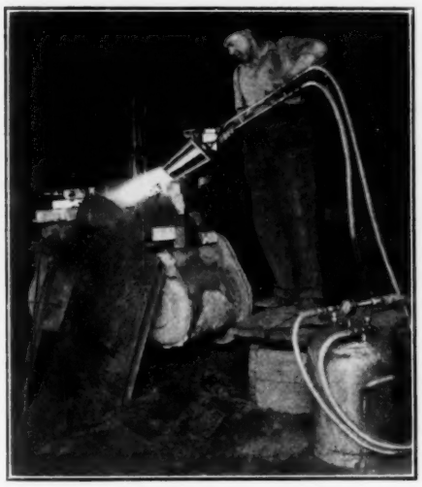


Combination Riddle and Sand Mixing Machine

hopper in which the sand is mixed is located in the center of the main frame and extending through the center of the hopper is a shaft on which is mounted a reel for turning and cutting the sand, which revolves in the same direction as the hopper. The hopper is also provided with a scraper which prevents the sand from accumulating on the side of the hopper and a water connection is also provided for tempering the sand while it is being mixed in the hopper.

Oil Burner for Burning-On

The method of reclaiming a defective, gray iron, water filter valve casting, weighing about 3,000 pounds, by burning-on with a portable oil burner, is shown in the accompanying illustration. The casting contained a shrink hole in



METHOD OF REPAIRING A DEFECTIVE GRAY IRON CASTING WITH A PORTABLE OIL BURNER

one of its three flanges, this shrink hole having been 4½ inches wide and about 2½ inches deep. When repairing this defect, a section of sheet steel was placed about 12 inches underneath the body of the casting where the burn was made, to support the bricks and sand necessary to form a basin. The flame of the burner was directed against the surface to be repaired until it was raised to a cherry red heat, when cores were set in position and held with a sand bank to direct the flow of the molten metal into the shrink hole. To prevent the possibility of the casting cracking after the burn was made, the flame of the burner was passed over the casting which was heated throughout to insure a more uniform expansion and a consequently uniform contraction. Approximately 120 pounds of metal were required. The oil burner used was of the type manufactured by the Hauck Mfg. Co., Brooklyn, N. Y.

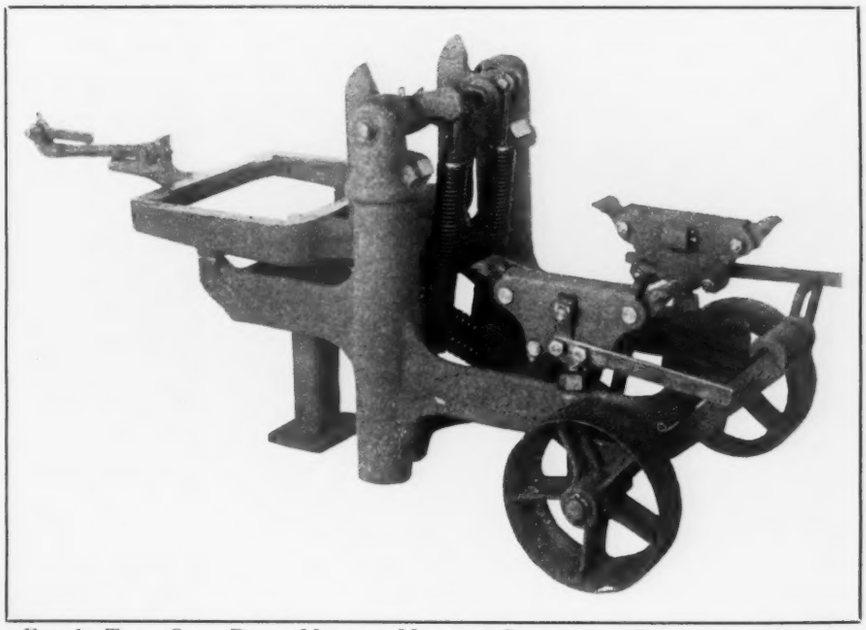


FIG. 1—TURN-OVER DRAW MOLDING MACHINE BEFORE THE PATTERN IS MOUNTED

Turn-Over Draw Molding Machine

A turn-over draw molding machine, built by the International Molding Machine Co., Chicago, and installed in the foundry of a large eastern machine tool builder, is shown in the accompanying illustrations. On this machine the mold is turned over onto a receiving table and the pattern is drawn out of the mold. In Fig. 1 is shown the machine before the pattern is mounted and in Fig. 2 the pattern board with a pattern of a cone pulley is shown attached to the turn-over frame. In Fig. 3, the flask has been rammed and the bottom board has been clamped to the turn-over frame in position to roll-over the mold. In Fig. 4, the mold has been turned over and the pattern drawn, and in Fig. 5 the flask has been lifted off and the pattern frame is swung back preliminary to making the next mold. The mold is shown at the left.

Machine-molding a cone pulley is a difficult operation, inasmuch as the flask is deep, but special provision has been made for this flask in the construction of this machine by locating the ramming bed close to the floor. This pattern, when properly made, should have practically no draft and the machine must consequently draw the pattern absolutely straight. The method of accomplishing this is shown by the change in the positions of the pattern-carrying

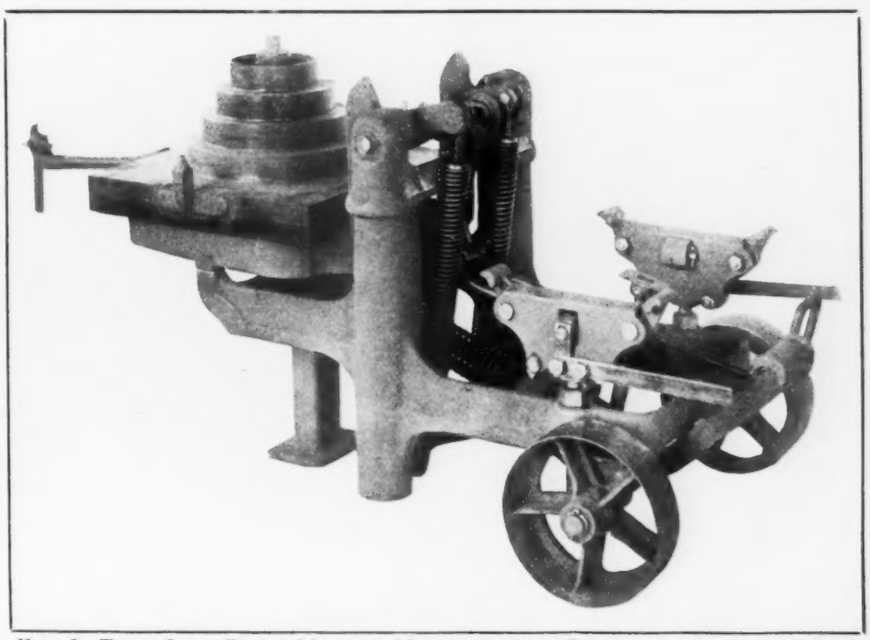


FIG. 2—TURN-OVER DRAW MOLDING MACHINE WITH PATTERN OF A CONE PULLEY MOUNTED ON THE PATTERN BOARD

FIG. 3—THE FLASK RAMMED AND THE MOLD CLAMPED TO THE TURN-OVER PATTERN FRAME

FIG. 4—THE MOLD TURNED OVER AND THE PATTERN DRAWN

frame and the frame and frame shaft and bearings, in Figs. 3 and 4.

The turn-over frame is mounted and revolves on a horizontal steel shaft, to both ends of which are attached heavy cast iron bearings having circular openings drilled in their lower sides. Into these openings parallel steel uprights are driven and cross-pinned, which travel in the circular columns in the main frame of the machine. These columns, controlling, as they do, the action of the pattern frame raising shafts, must be fitted to the utmost degree of accuracy. They are drilled by a templet and brass-bushed their entire length to a diameter corresponding to that of the steel shafts to be engaged. The pattern is drawn by pressing the foot lever, which is conveniently located in front of the machine and which is connected with the turn-over frame supporting shaft by means of a heavy cast iron crank and connection. The turn-over frame balance springs are of such size and strength that they perfectly counterbalance the weight of the frame with the pattern board and pattern, as illustrated in Fig. 5. This adjustment relieves the operator of all exertion in turning over the mold. The four points of contact of the leveling device act independently of each other and thus insure the accurate leveling of the bottom board and the mold. The use of this machine on this particular pulley pattern has effected a reduction in the cost of molding amounting to 62 per cent.

Another machine of the same type used in this shop, but of a larger size, is shown in Fig. 6. A pattern of a lathe base is mounted on the pattern board. The flask used is 30 inches wide and the machine has a straight pattern draw of 14 inches. When required for larger work, these machines are operated by power for turning over the mold and drawing the pattern.

Warner R. Thompson is now affiliated with Jno. S. Lorimer's Sons, Detroit, in the capacity of manager of the sand and coke department. This concern makes a specialty of molding and core sands, fire clay and coke for foundry use.

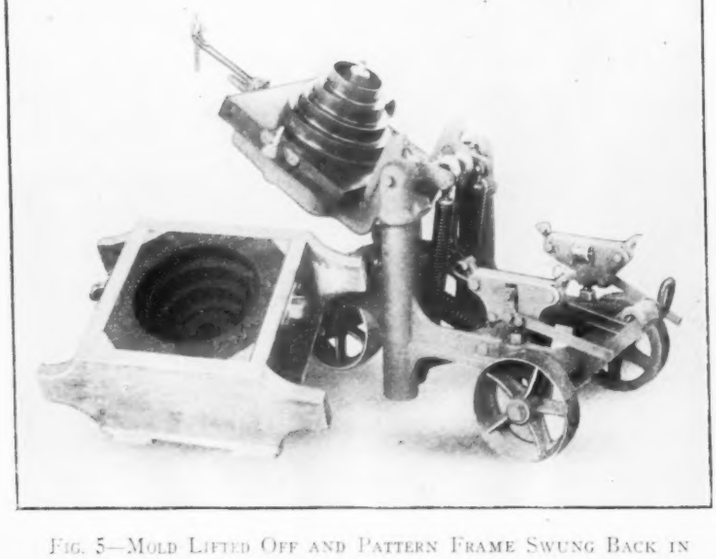


FIG. 5—MOLD LIFTED OFF AND PATTERN FRAME SWUNG BACK IN POSITION FOR THE NEXT MOLD

FIG. 6—LARGE MACHINE, ON WHICH THE PATTERN OF A LATHE BASE IS MOUNTED

FIG. 1—ROLLING OVER A LARGE CORE ON THE BENCH, JOLT-RAMMING CORE MACHINE

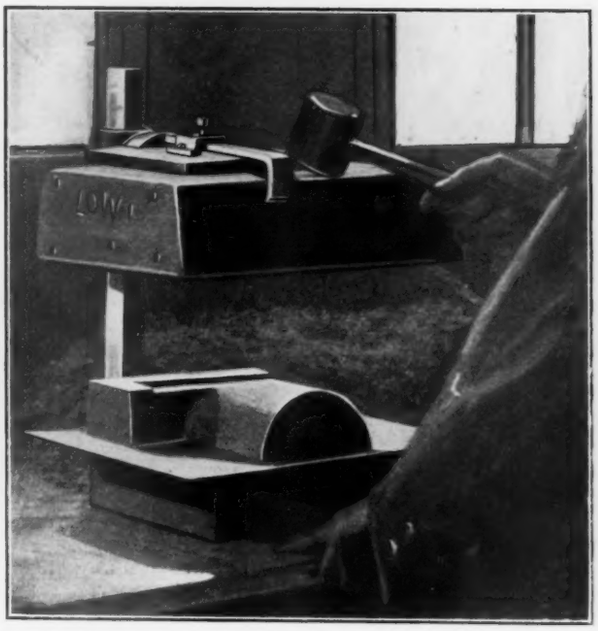
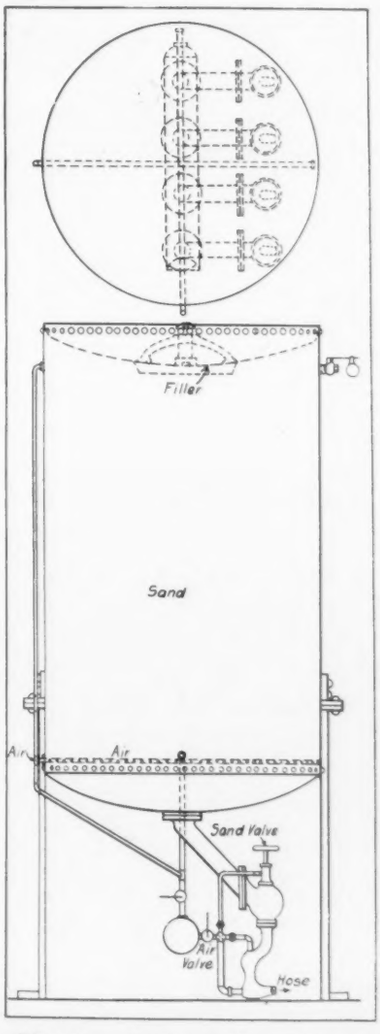


FIG. 2—METHOD OF LIFTING THE CORE BOX FROM THE CORE

A Bench Jolt-ramming Core Machine

A jolt-ramming core machine, manufactured by the Detroit Core Machine Co., Detroit, is shown in the accompanying illustrations. This machine is so constructed that it can be readily attached to the core bench, and as it takes up little space when not in use, it does not interfere to any appreciable extent with the use of the bench for hand work. The machine is operated by means of a foot lever underneath the bench, which is connected to the upright bar of the machine that passes through the table of the bench. Fig. 1 shows the machine attached to the core bench, and the operator is rolling over a large core, which is easily accomplished with one hand, the plate being held by the clamping device shown, which forms a part of the machine. Without the aid of the machine, two men would be required to roll over this core, a view of which is shown at the left of the illustration. In Fig. 2, the core box is shown after it has been raised off the core by the vertical movement of the square upright bar, which extends through the table and is operated by the pressure of the foot on a lever underneath the bench.

Either wood or metal core boxes can be used, and the manner in which they are clamped to the platen of the machine is clearly shown. In the case of small core boxes, two or more boxes can be held together, and thus several cores can be made in one operation. The two blocks of wood underneath the core plate in Fig. 2 hold the core box level, and prevent the clamp from striking the bench, while the core is being jolt-rammed by the reciprocating movement of the upright bar produced through the medium of the foot lever. During this operation the core box is inverted from the position shown. After the sand has been rammed, the core plate is bedded-on and clamped in place while it is being rolled over in the manner shown in Fig. 1.



MULTIPLE INJECTOR SAND BLAST

Multiple Injector Sand Blast

In the accompanying illustration is shown a side elevation of a sand tank which is a part of the multiple injector sand blast built by J. M. Betton, 178 Washington street, New York City. To the bottom of this tank are attached, by flanges, one, two, three or four sand outlets and in the plan view of this tank it will be noted that four sand outlets have been provided. This tank is built of steel plates and the sand is subjected to a pressure of 80 pounds. The head and bottom are dished and a large sand inlet, which is closed by a manhole cover, is provided in the head. The sand valve, which controls the flow of sand, is provided with a central air jet which insures the uniform flow of the sand. The air supply is piped from the air receiver near the compressor to a steel riveted manifold placed horizontally under the sand tank. The air to each outlet is controlled by a single, lever handle, quick-opening gate valve, the supply being piped to the sand valve, mixing and forcing openings, and thus each outlet can be independently controlled and operated. The manifold also serves as an air separator and has

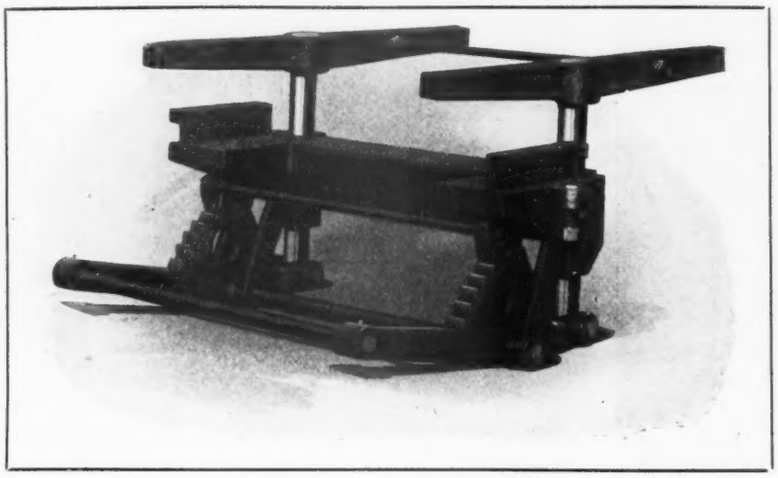


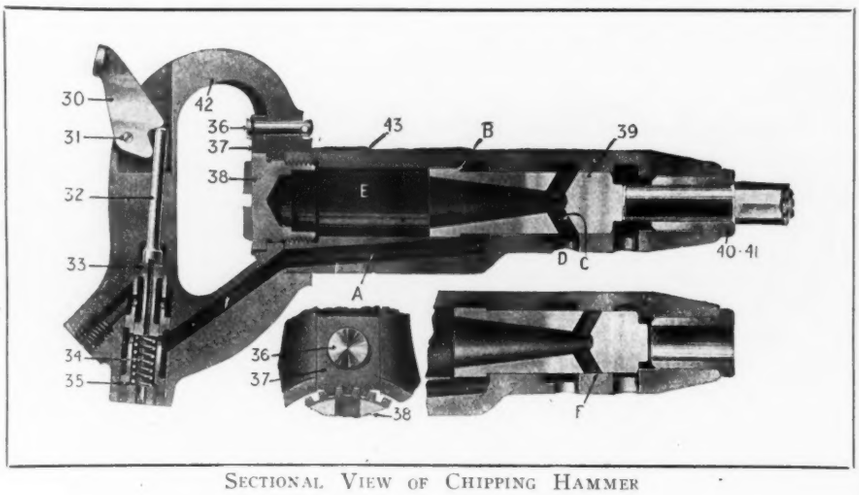
FIG. 1—ADJUSTABLE FLASK SUPPORT FOR ROLL-OVER MOLDING MACHINE

proper drainage facilities. By means of a separate connection controlled by one valve, compressed air is admitted to the upper part of the tank and it is also delivered to two perforated tubes placed at right angles to each other near the bottom of the tank, which agitate the sand and further facilitate its flow.

From each outlet, mixed currents of air and sand are delivered through a hose and discharged from the sand nozzle. These tanks are built in various capacities for 2,000, 4,000, 6,000 and 16,000 pounds of sand and are provided with one, two, three or four outlets. While these outlets are usually located in a line, they can be placed at any point on the bottom of the tank. Any one of these sand blasts can be operated at an air pressure up to 80 pounds per square inch, without change or adjustment. With this attachment it is possible to attach the injector sand blast apparatus to the bottom or sides of any closed tank from which sand will flow and in such number as may be required, each one being separate from and independent of all others in operation. This system will prove of value in foundries where the output of similar castings is large, including such work as bath tubs, lavatories, etc. By this arrangement, the tank will serve four sand blast cleaning rooms and it is claimed that by the addition of a second and superimposed tank with suitable piping and valves, the work of sand-blasting can be carried on continuously.

Adjustable Flask Support

In Fig. 1 is shown an adjustable flask support for roll-over molding machines, manufactured by the Tabor Mfg. Co., Philadelphia, which eliminates blocking up the leveling device when using flasks of less depth than the maximum capacity of the machine. In its lowest position the cross bars of the support are level with the main frame of the machine and may be raised 4½ inches by depressing the elevating lever, this distance being divided into six different positions, ¾ inch apart. The cross bars are held in place by a pawl and ratchet on either side and may be lowered by releasing the pawl. This device can be fitted to Tabor roll-over machines by placing it on the frame of the machine and fastening it with set screws provided for this purpose. In Fig. 2 the adjustable flask support is shown in position on the roll-over molding machine. The leveling device is shown in position on the flask support in this illustration and consists of a rectangular frame, which carries an inner floating frame on which the flask rests. The floating frame rides on beveled corners of the outer frame and is free to move



SECTIONAL VIEW OF CHIPPING HAMMER

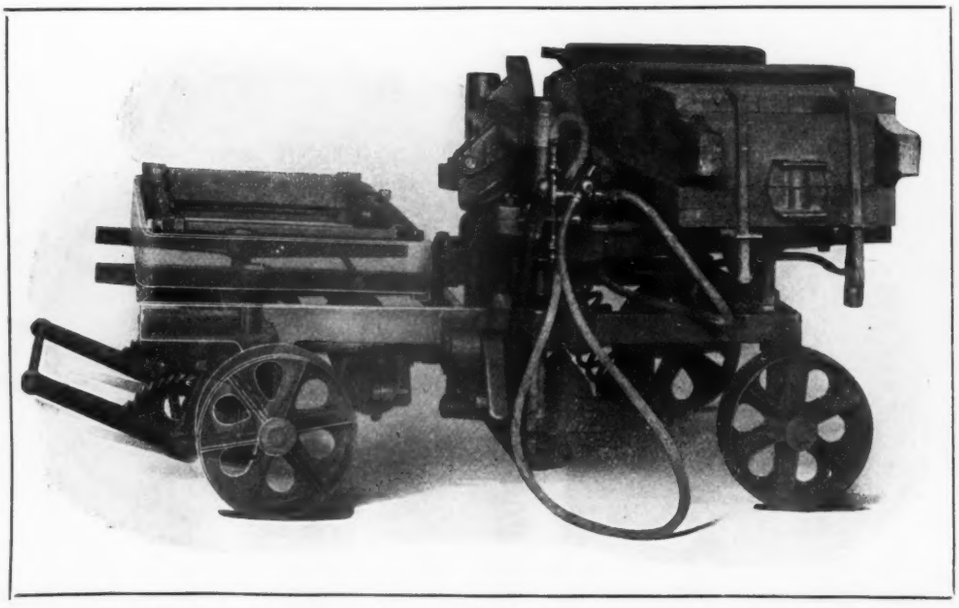


FIG. 2—ADJUSTABLE FLASK SUPPORT IN POSITION ON THE ROLL-OVER MACHINE

Payment will be made for all contributions on foundry and pattern shop practice suitable for publication.

COMPOSITION OF NON-FERROUS ALLOYS.

The following specifications for the composition of non-ferrous alloys were issued by the United States Bureau of Steam Engineering, July 1, 1910:

Specifications for Casting Materials.

The composition must be made of such materials as will give the required chemical analysis. Scrap will not be used except such as may result from the process of manufacture of articles of similiar composition.

Valve Bronze.

	Per cent.
Copper	87
Tin	7
Zinc	6
Iron	0.06*
Lead	1.00*

Manganese Bronze.

	Per cent.
Copper	57 to 60
Zinc	37 to 40
Tin	0.75
Iron	1.00*
Aluminum	0.50*
Manganese	0.30*

Monel Metal Castings.

	Per cent.
Copper	33
Nickel	60 minimum
Iron	6.5
Aluminum	0.5
Lead	None

Cast Naval Brass.

	Per cent.
Copper	59 to 63
Zinc	35.5 to 40.5
Tin	0.5 to 1.5
Iron	0.06*
Lead	0.60*

Phosphor Bronze.

	Per cent.
Copper	80 to 90
Tin	6 to 8
Zinc	2 to 14
Phosphorus	0.30
Iron	0.06*
Lead	0.20*

*Maximum.

Note—This sheet may be cut into two sections, 5 x 7 inches, and may be readily bound in note-book form.

COMPOSITION OF NON-FERROUS ALLOYS.

The following specifications for the composition of non-ferrous alloys were issued by the United States Bureau of Steam Engineering, July 1, 1910:

Composition for Brass Screw Pipe Fittings.

	Per cent.
Copper	77 to 80
Zinc	13 to 19
Tin	4.0
Iron	0.10*
Lead	3.00*

Thrust Rings.

	Per cent.
Copper	82 to 84
Tin	12.5 to 14.5
Lead	2.5 to 4.5

Monel Metal Ingots.

	Per cent.
Nickel	60
Copper	38
Manganese	2

Small percentages of other ingredients will be permitted in Monel metal ingots, provided that they do not affect the casting qualities or are detrimental to the strength or non-corrosive properties of the metal.

Aluminum Alloys.

An aluminum alloy known as "Partenium," and named after its inventor, G. H. Partin, follows:

	Per cent.
Copper	78
Tin	20
White arsenic	2

Melt the copper under charcoal, and when liquid throw the arsenic, which has been previously wrapped in paper, onto the surface of the copper and when thoroughly heated stir into the metal. Pour the alloy into ingots and afterwards break up as fine as possible and mix with 1 per cent tungsten and 3 per cent of pulverized antimony. This mixture is again remelted and afterwards poured into ingots and forms the hardening alloy, which is used as follows:

	Per cent.
Aluminum	96
Hardening alloy	4

To make the alloy, first melt a portion of the aluminum heat until a deep red, and add the hardening alloy; when dissolved, charge the remainder of the aluminum.

*Maximum.

in any direction until the bottom board bears on it at four points, when the weight of the mold will cause it to lock in the proper position to insure a perfectly level flask. When the mold is removed, the floating portion is free to move in any direction required by the next flask used. After the mold is rolled over and before it is unclamped, the pattern drawing lever should be pressed down so that the flask will be deposited in a horizontal position, when the lever is again raised. A set screw at the back of the leveling device serves to give it a firm bearing on the frame of the machine.

Foundry Chipping Hammer

In the accompanying illustration is shown a cross-section of a chipping hammer, adapted for foundry use, manufactured by the Pittsburg Pneumatic Co., Canton, O. The throttle valve of this hammer is of the balanced piston type and is so designed that when closed it by-passes the port *A* to the atmosphere through the opening in the plug at the bottom, thus preventing leakage in the valve from operating the piston when the thumb lever is released. While in operation, this chipping hammer may be either gradually or suddenly withdrawn from the chisel. When backed from the chisel ⅜ inch or more, the hammer becomes inoperative, as the piston is held by full pressure in its forward position, as shown in the sectional view, until the release of the thumb lever releases the pressure in the cylinder. An enlarged view of the cap-lock is also shown in the accompanying illustration. The pawl, *37*, fits closely into a groove, which is milled in the handle and is provided with teeth which mesh into those in the cap, *38*. As the teeth on the pawl and cap are of ample strength, the cap cannot work loose. It will be noted that the teeth of the pawl are not exactly on center, so that by turning it half over, an adjustment of one-half tooth on the cap may be obtained. The handle is designed to fit the hand comfortably, and is carefully proportioned to withstand the strains due to vibration.

Trade Note

The latest number of the "Revised American Statesmen Series", by F. W. Haskell, which contains a sketch of Capt. John Smith, is being sent to the trade by the Carborundum Co., Niagara Falls, N. Y.

The Ohio Sand Co., Conneaut, O., miner and shipper of molding sand, is sending novel blotting stones to the foundry trade to remind the foundrymen of the reopening of the molding sand shipping season.

The Federal Foundry Supply Co., Cleveland, has appointed H. L. Sears, 39 Lewis Place, St. Louis, traveling salesman in charge of the Illinois and part of the Indiana and Missouri territories.

The Sterling Wheelbarrow Co., West Allis, Wis., has been appointed exclusive agent in the United States for the patented snap flask, manufactured by the Chas. Jurack Pattern Works, Milwaukee.

Frederic B. Stevens, Detroit, has recently installed a No. 26 Colliau cupola in the foundry of the Jones Machine Co., Chattanooga, and a No. 28 Colliau cupola in the plant of the Quality Beds, Ltd., Welland, Ont.

In the plant of the Bayonne Steel Casting Co., Bayonne, N. J., described in the April issue of THE FOUNDRY, the molding machine equipment, which is unusually complete, includes two 19 x 24-inch power-ramming, split pattern molding machines and one 6-inch jolt-ramming molding machine, installed by the Mumford Molding Machine Co., 30 Church street, New York City.

The Sullivan Machinery Co., Chicago, has established a branch office at 35 Federal street, Boston, to permit more adequate service of its patrons in New England, Eastern Canada, and the Maritime Provinces. George E. Wolcott, for several years manager of New England sales at the company's Claremont (N. H.) office, is in charge of the Boston headquarters.

Dr. E. A. Beck has been appointed to the force of metallurgists employed by the Goldschmidt Thermit Co., 90 West street, New York City. Dr. Beck brings to his new position a varied experience in the metallurgical field and this concern will gratuitously give advice on all questions relating to the use of its metals and alloys in the production of special steels, brass and bronze.

The Ridge View Sand Co., Oil City, Pa., has recently been organized to engage in the mining and shipping of high-grade silica sand for steel foundry use. The sand analyzes as follows: Silica, 99.108 per cent; aluminum, 0.585 per cent; iron oxide, 0.075 per cent; lime, 0.101 per cent; and magnesia, 0.116 per cent. The plant is located at Ridge View, five miles from Oil City, and has a capacity of 600 tons per day. The officers of the company are as follows: C. W. Coulter, president; Stuart H. Simpson, vice president; Samuel W. McCuen, secretary and treasurer, and R. L. Rhodes, superintendent.

The Taylor Steel Co.'s foundry, Plain City, O., has been leased by the Steel Products Co.

Trade Publications

HOISTS, TROLLEYS AND CRANES.—The Climax Hoist Co., Philadelphia, in a 32-page catalog, illustrates and describes its extensive line of hoisting machinery, including spur-geared chain hoists, single I-beam trolleys, three-motor electric traveling cranes, hand traveling cranes and jib and gantry cranes.

AIR COMPRESSORS.—In a 20-page bulletin issued by the Sullivan Machinery Co., Chicago, straight-line air compressors with single steam and two-stage air cylinders are illustrated and described. These compressors are particularly adapted for foundry use. Views of various installations are included.

CRUCIBLES.—The Paige Retort Crucible Co., Taunton, Mass., is sending to the trade a six-page folder, which illustrates and describes a special crucible for an oil melting furnace, as well as pots of standard shapes. A list of sizes is also included. This concern manufactures crucibles of all sizes, bowls, dippers, stirrers, retorts, etc.

FOUNDRY EQUIPMENT.—In a four-page circular, the Hanna Engineering Works, Chicago, briefly illustrates its line of foundry equipment which consists of pneumatic tripod, frame post and swivel post sand shakers, revolving dumping riddle, etc. The latter is furnished mounted on wheels if desired.

GENERATORS.—In a 16-page bulletin, issued by the Allis-Chalmers Co., Milwaukee, its line of small generating sets is illustrated and described. These are intended for small isolated lighting and power plants and consist of a combination of generators built by the Allis-Chalmers Co. and engines built by the American Blower Co., Detroit.

BLOWERS AND FANS. — The American Blower Co., Detroit, has recently issued a number of bulletins which illustrate and describe its various products, including cast iron volume blowers, steel pressure blowers, steel plate exhaust fans, cooling tower fans, disc ventilating fans and mine fans. A small booklet is devoted to Sirocco ventilating sets and vertical self-oiling engines are illustrated and described in a 52-page bulletin.

SPRAY NOZZLES AND STRAINERS.—The Buffalo Forge Co., Buffalo, in a 16-page folder, illustrates its line of spray nozzles and strainers adapted for use at blast furnaces, for gas washing, condenser systems, cooling towers, etc. These nozzles can be used for any purpose for which a fine spray is essential, such as for moistening air under any condition or for settling dust and ashes.

MELTING FURNACE.—The Rockwell Furnace Co., 26 Cortlandt street, New York City, in bulletin No. 28, describes an oil or gas-fired furnace for melting aluminum, brass, bronze, copper, ferro-manganese, gray iron, semi-steel, etc. These furnaces are of the open-flame type and are lined with carborundum, ganister or fire tile. Low pressure blast is used. The time required for melting varies with the kind of metal melted, but eight heats of average brass mixture can be melted per day in a 500-pound furnace and four heats in a 6,000-pound furnace. These furnaces are built in capacities up to 24,000 pounds.

BRUSHES.—A line of scratch wheel and tampico wheel brushes for use in foundries and plating plants, is illustrated and described in a 6-page folder issued by the Manufacturers Brush Co., 2187 East Second street, Cleveland. These brushes are made in discs or sections, which permits of the manufacture of a brush having any desired width of face, eliminating the use of a special hub or holder. The brushes are made of specially prepared

wire which wears uniformly and permits the use of the brush until entirely worn out. A list of prices is also included.

TITANIUM.—In a booklet issued by Geo. G. Blackwell, Sons & Co., Ltd., Liverpool, England, the use of titanium in iron and steel is discussed at length. A special titanium alloy is made by this concern for iron foundry work, which cleanses the iron, removes nitrogen and oxides and eliminates brittleness and blow holes. Castings containing this titanium alloy, when tested, show increased tensile strength, greater compressive strength and durability. Chilled car wheels, etc., containing titanium, show a remarkable increase in wearing properties. The alloy is crushed fine and is added to the metal in the ladle. However, the best results are obtained by pre-heating the crushed alloy.

BRUSHES.—In a 16-page catalog, issued by the Riehl Mfg. Co., 5411 Bower avenue, Cleveland, the extensive line of wire, tampico, bristle and horse hair wheel brushes manufactured by this concern are illustrated and described. These wheels are built-up in sections which are slipped into an aluminum self-locking hub. A brush of any width can be made with these sections, each section being equal to a ¼-inch face. The fine wire wheels made by this concern, 2½ to 6 inches in diameter, are of metal construction throughout, and wire wheels 6 inches and upwards in diameter are built-up in sections on a permanent aluminum hub. Scratch wheels are built-up in sections, held together by a hub fitted with steel side plates. These wheels are made of special, oil-tempered wire.

METALS AND ALLOYS.—A 28-page booklet, issued by the Electric Smelting & Aluminum Co., Lockport, N. Y., is devoted to the various alloys manufactured by this concern. These include nickel aluminum, which contains about 93 per cent of aluminum, some copper and a percentage of nickel; aluminum bronze, which contains 5 per cent aluminum and 95 per cent copper; 10 per cent aluminum bronze, which is an alloy of nine parts of lake copper and one part of aluminum; silver bronze, which is used for making art castings and for electrical work, etc. Among the deoxidizing agents made by this concern are silicon-copper, phosphor-copper, etc. Among other alloys are included manganese-copper, manganese alloy, manganese bronze, phosphor tin, babbitt metals, etc. This company is also a manufacturer of aluminum which is guaranteed over 99 per cent pure and is furnished in small notched ingots ready for the crucible.

General Industrial Notes

Roland Firth & Son, Phillipsburg, N. Y., founders and machinists, will build a steel casting plant of 10 tons daily capacity.

The L. W. Pond Foundry & Machine Co., Worcester, Mass., is building a new foundry, 66 x 261 feet.

The Peerless Crucible Steel Casting Co., Detroit, has been incorporated with a capital of $20,000.

The Ottumwa-Moline Engine & Pump Co., Ottumwa, Ia., has a part of its new plant completed. A foundry building, 80 x 120 feet, will be erected during the summer.

The Union Iron Works, Decatur, Ill., manufacturer of elevating, conveying and transmission machinery, is erecting a foundry, 60 x 154 feet.

The Western Machine & Foundry Co., Santa Barbara, Cal., is adding new buildings to its plant, which include an addition to the foundry.

The Erie City Iron Works, Erie, Pa., will enlarge its plant by the erection of a foundry, 250 x 600 feet, and a pattern storage building.

The Superior Foundry & Mfg. Co., Belleville, Ill., has been incorporated with a capital of $5,000. The incorporators are O. Welker, J. Hanwar and W. M. Hoppe.

The Equalizer Foundry Co., Chicago, has been incorporated with a capital of $30,000 and will engage in the manufacture of hardware specialties.

Arbuckle & Co., Rushville, Ind., have been incorporated with a capital of $50,000 and will operate a foundry. Nathan and James W. Arbuckle and Wallace Morgan are the directors.

The Stover Engine Works, East Freeport, Ill., is increasing the capacity of its plant by the erection of two new buildings and additions to the machine shop and foundry, the capacity of the latter being doubled.

The Cincinnati Steel Castings Co., Cincinnati, has acquired a site on which to erect a new plant. The proposed building will be of brick and steel construction, 75 x 150 feet, two stories high.

The Farrel Foundry & Machine Co., Ansonia, Conn., is building an addition to its heavy roll foundry, 35 x 260 feet. The building will be constructed of brick and steel and will be equipped with two traveling cranes.

The Perfect Stove & Mfg. Co., Belleville, Ill., recently incorporated with a capital stock of $10,000, will erect a foundry and will conduct a general jobbing foundry business in addition to producing castings for its line of steel ranges.

The Architectural Iron Co., Columbus, O., recently incorporated with a capital of $25,000, will take over the plant and business of the H. & H. Art Metal & Mfg. Co., Cleveland. The latter concern manufactures ornamental iron, bronze and brass work.

The Trenton Foundry & Machine Co., Trenton, N. J., has been incorporated with a capital of $50,000 and will carry on a general foundry and machine business. The incorporators are E. M. Jonson, E. W. Watson and B. Bedford.

The Jones Machine Co., Chattanooga, Tenn., is increasing its plant by the erection of a foundry, 40 x 60 feet. A cupola will be installed having a capacity of three tons per hour, and the company will do a general jobbing business.

The Browning Foundry Co., Ravenna, O., is enlarging its plant by the addition of an open-hearth steel foundry. Two open-hearth furnaces will be installed, and in addition to the foundry, a fireproof pattern storage and other buildings will be erected.

The Lorain Metal Products Co., Lorain, O., has been formed and will effect a consolidation of the Stander foundry, the O'Brien Brass Works and the B. R. Maddock Pattern Works. The company will operate in the Stander plant. B. R. Maddock is manager.

The Milwaukee Steel Foundry Co., Milwaukee, Wis., is enlarging its plant by the erection of an addition, 80 x 250 feet. The new building will be constructed of concrete and steel with metal window frames and sash. This addition will practically double the capacity of the plant and will cost $30,000. J. G. Shaw is president and general manager.

The George H. Smith Steel Casting Co., Milwaukee, is erecting a one-story brick and steel addition, 60 x 154 feet, which will be used as a cleaning and shipping department. A 10-ton electric traveling crane will serve the new addition, and tumbling barrels and other casting cleaning apparatus will be installed.

The Whitin Machine Works, Whitinsville, Mass., manufacturer of textile machinery, will build an addition to its foundry, 100 x 500 feet. The present foundry, erected three years ago, is 200 x 500 feet. The new building will be of brick and steel construction, and will be located between the old foundry and the Mumford river.

Among the Brass Founders.

The Doehler Die Casting Co., Brooklyn, N. Y., has enlarged its plant by the erection of a four-story addition, of brick and concrete construction.

The Ajax Foundry & Pattern Works, Milwaukee, recently incorporated with a capital of $10,000, will take over the plant of the Elite Foundry Co., of that city.

The Elgin Brass Foundry, Elgin, Ill., has been purchased by Frank M. Connoly, Racine, Wis., and will continue to be operated under the same name.

The Forest City Brass Co., Wellsburg, W. Va., has been formed and has leased the factory of the Riverside Glass Co., which has been idle since 1907, and will equip it as a brass foundry.

The Frontier Brass Foundry, Niagara Falls, N. Y., is erecting a brass foundry, of concrete and steel construction. Twelve furnaces will be installed and the company will engage in the jobbing brass foundry business.

The G. L. Anderson Brass Works, Birmingham, Ala., has been incorporated and will succeed G. L. Anderson in the jobbing brass foundry business. The incorporators are G. L. and J. M. Anderson.

The J. P. Eustis Mfg. Co., Boston, manufacturer of bath room fixtures, metal frame mirrors and fine art metal goods, removed to its new factory on Ames street, Cambridge, Mass., where a fireproof building has been erected.

The New York State Casting Co., Syracuse, N. Y., has been recently incorporated and will engage in the manufacture of aluminum, brass and high grade iron castings. A large part of the plant of the Syracuse Stove Works will be occupied by the new company.

The Vanadium Metals Co. is building a plant at Groton, Conn., across the harbor from New London, Conn. The foundry will be 62 x 227 feet. The company is at present located in East Braintree, Mass., and succeeded the Victor Metals Co., of the same place. Victor Lassen is the general manager.

The Standard Brass Casting Co., Oakland, Cal., is erecting a foundry, 100 x 100 feet, of brick construction and two stories high. Additional oil furnaces are being installed which will increase the melting capacity to 7,000 pounds per heat. A five-ton traveling crane is also being installed.

The Acme Foundry Co., successor to the Acme Brass Foundry, Indianapolis, has installed a cupola and will engage in the manufacture of gray iron castings. Heretofore this concern has manufactured non-ferrous metal castings exclusively. The officers of the company are John M. Haines, president; Ferris T. Taylor, vice president, and Joseph L. Hall, secretary and treasurer.

CRANES--EVERY TYPE FOR EVERY SERVICE

ELECTRIC TRAVELERS

Grey Iron Foundry, Illinois Steel Company, South Chicago

COMPLETE EQUIPMENT FOR FOUNDRIES

FOR ALL CLASSES OF CASTINGS

Grey Iron, Brass, Car Wheel, Pipe, Steel and Malleable

Layouts Furnished . Equipment Installed

Plants turned over to owners Ready to Operate

Sales Agencies

NEW YORK, Wonham, Sanger & Bates, 30 Church St.
PITTSBURG, Samuel W. Hay's Sons, 1415 Keenan Bldg.
CINCINNATI, S. Obermayer Co.
ST. PAUL, Robinson, Cary & Sands Co., 4th & Wacouta Sts.
RICHMOND, VA., Smith - Courtney Co.
BIRMINGHAM, ALA., Dewstoe Machine Tool Co., Brown-Marx Bldg.
DENVER, Hampson-Fielding Engr. Co., 1711 Tremont St.
WASHINGTON, D. C., H. A. Gillis, Home Life Bldg.
SALT LAKE CITY, F. E. Arnold, Atlas Block.

WHITING
FOUNDRY EQUIPMENT CO.
HARVEY-ILL. U. S. A.
CHICAGO SUBURB.

Sales Agencies

SEATTLE, WASH., Caldwell Bros. Co., 1014 First Ave., South
SAN FRANCISCO, Henshaw-Bulkley & Co., 19 Fremont St.
MONTREAL, Dominion Foundry Supply Co., 47 Murray St.
WINNIPEG, J. A. McTaggart & Co.
EDMONTON, ALTA., Gorman, Clancey & Grindley Co.
MEXICO CITY, Mexican Steel Products & Machinery Co.
MONTEREY, MEX., Sanford & Cia.
LONDON, ENG., J. W. Jackman & Co., Ltd., Caxton House, West
PHILADELPHIA, PA., J. Jacob Shannon & Co., 1744 Market St.

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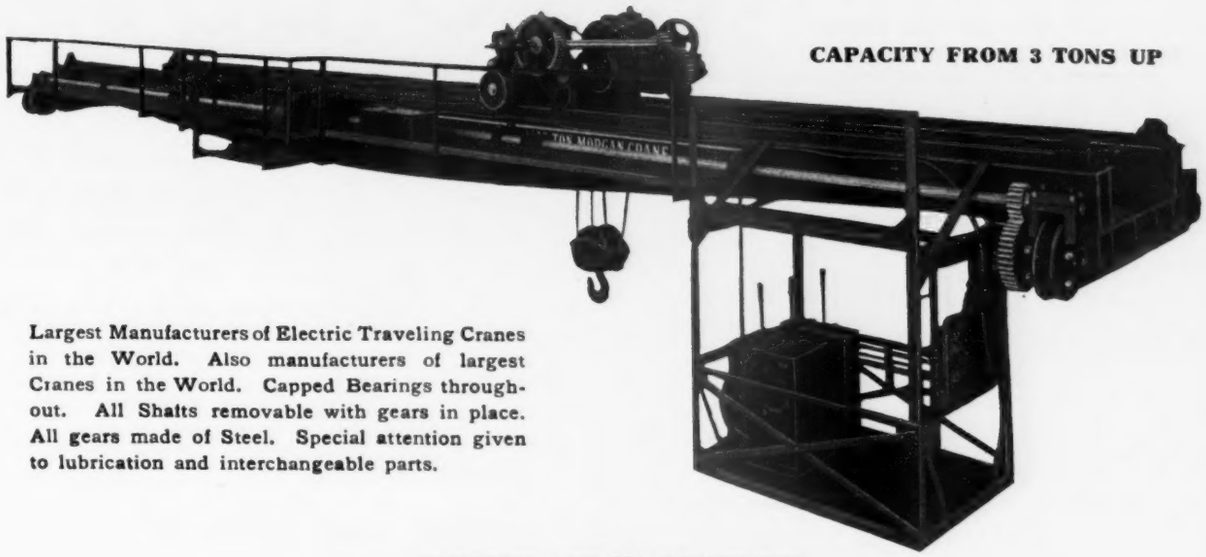

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Largest Manufacturers of Electric Traveling Cranes in the World. Also manufacturers of largest Cranes in the World. Capped Bearings throughout. All Shafts removable with gears in place. All gears made of Steel. Special attention given to lubrication and interchangeable parts.

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Pioneer Crane Builders. 3300 Cranes in Successful Operation.
Also Builders of Hammers, Shears and all kinds of heavy Special Machinery.

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Frick Building
BIRMINGHAM, ALA.
Brown-Marx Bldg
BRUSSELS, BELGIUM
COPENHAGEN
TOKIO

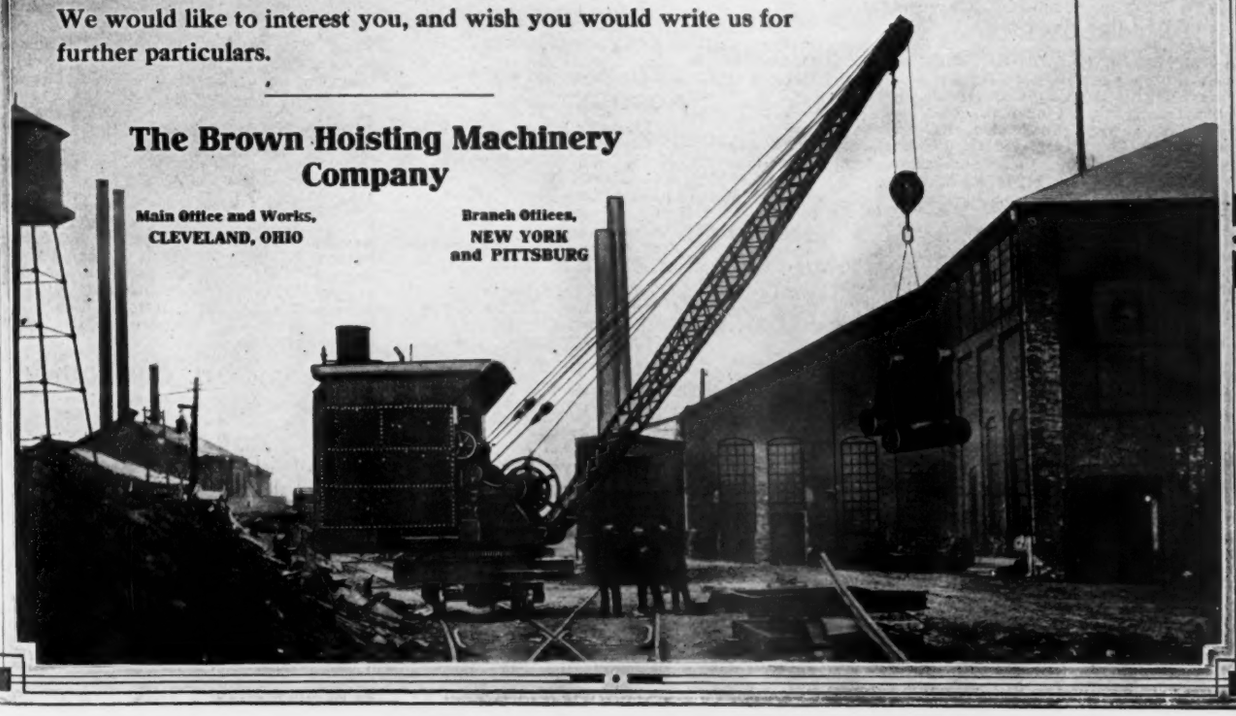
"Brownhoist" Locomotive Cranes

Foundries who are using our LOCOMOTIVE CRANES say they cannot dispense with them, and that they are the most useful equipments around their plants. We would like to interest you, and wish you would write us for further particulars.

The Brown Hoisting Machinery Company

Main Office and Works,
CLEVELAND, OHIO

Branch Offices,
NEW YORK
and PITTSBURG



WHERE TO BUY

AIR COMPRESSORS.

American Air Compressor Works, New York.
American Compressor & Pump Co., Baltimore.
Curtis & Co. Mfg. Co., St. Louis, Mo.
Gardner Governor & Fdy. Co., Quincy, Ill.
General Electric Co., Schenectady, N. Y.
Ingersoll-Rand Co., New York, N. Y.
Norwalk Iron Works Co., So. Norwalk, Conn.
Pangborn Co., Thos. W., New York City.
Sullivan Machinery Co., Chicago, Ill.

AIR SEPARATORS.

Pangborn Co., Thos. W., New York City.

AIR VALVE AND LUBRICATOR.

Pangborn Co., Thos. W., New York City.

ALLOYS.

Ajax Metal Co., Philadelphia, Pa.
Blackwell, Geo., Sons & Co., Ltd., Liverpool, Eng.
Electric Smelting & Aluminum Co., Lockport. N. Y.
Phosphor Bronze Smelting Co., Ltd., Phila., Pa.
Titanium Alloy Mfg. Co., Pittsburg, Pa.
Uraniumite Co., Buffalo, N. Y.

ANALYSIS.

(Mechanical.)
Keep, W. J., Detroit, Mich.

ANNEALING OVENS.

Whiting Foundry Equipment Co., Harvey, Ill.

BABBITT METAL.

Ajax Metal Co., Birmingham. Ala.
Phosphor Bronze Smelting Co., Ltd., Phila., Pa.

BARRELS.

(Factory.)
Cleveland Wire Spring Co., Cleveland, O.

BARROWS.

(Foundry.)
Osborn Mfg. Co., Cleveland, O.
Toledo Wheelbarrow Co., Toledo, O.

BELLOWS.

Dobson, Wm., Canastota, N. Y.
Kelly, T. P., & Co., New York, Chicago, Hamilton.
Obermayer, S., Co., Cincinnati, O.
Osborn Mfg. Co., Cleveland, O.
Paxson Co., J. W., Philadelphia, Pa.
Shanafelt Mfg. Co., Canton, O.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Providence, New York, Buffalo.

BLACKING MIXTURES.

Smith, J. D., Fdy. Supply Co., Cleveland, O.

BLOWERS.

American Blower Co., Detroit, Mich.
Buffalo Forge Co., Buffalo, N. Y.
Connersville Blower Co., Connersville, Ind.
Obermayer, S., Co., Cincinnati, O.
Paxson Co., J. W., Philadelphia, Pa.
Piqua Blower Co., Piqua, O.
Roots, P. H. & F. M., Co, Connersville, Ind.
Sturtevant, B. F., Co., Hyde Park, Mass.

BLOWERS.

(Positive Pressure.)
Connersville Blower Co., Connersville, Ind.
Piqua Blower Co., Piqua, O.
Roots, P. H. & F. M., Co., Connersville, Ind.
Sturtevant, B. F., Co., Hyde Park. Mass.
Wilbraham-Green Blower Co., Pottstown, Pa.

BOILER SETTINGS.

Harbison-Walker Refractories Co., Pittsburg.

BOWLS.

Paige Retort & Crucible Co., Taunton, Mass.

BOXES.

(Annealing.)
Whiting Fdy. Equipment Co., Harvey, Ill.

BOXES.

(Factory.)
Cleveland Wire Spring Co., Cleveland, O.

BRONZE.

(Manganese.)
Ajax Metal Co., Philadelphia, Pa.
Damascus Bronze Co., Pittsburg, Pa.
Electric Smelting & Aluminum Co., Lockport, N. Y.

BRUSHES.

Buckeye Products Co., Cincinnati, O.
Federal Fdry. Supply Co., Cleveland, O.
Manufacturers Brush Co., Cleveland, O.
McCormick Co., J. S., Pittsburg, Pa.
Obermayer, S., Co., Cincinnati, O.
Osborn Mfg. Co., Cleveland.
Paxson Co., J. W., Philadelphia, Pa.
Riehl Mfg. Co., Cleveland, O.
Shanafelt Mfg. Co., Canton, O.
Whitehead Bros. Co., Providence, New York, Buffalo.

BUCKETS.

(Grab.)
Pawling & Harnischfeger Co., Milwaukee, Wis.

BURNERS.

(Oil.)
Whiting Fdy. Equipment Co., Harvey, Ill.

CARS.

(Annealing, Pig Iron, Etc.)
Atlas Car & Mfg. Co., Cleveland, O.
Chase Foundry & Mfg. Co., Columbus, O.
Whiting Fdy. Equipment Co., Harvey, Ill.

CARS.

(Charging.)
Whiting Fdy. Equipment Co., Harvey, Ill.

CARS.

(Core Oven.)
Atlas Car & Mfg. Co., Cleveland, O.
Monarch Engrg. & Mfg. Co., Baltimore, Md.
Whiting Fdy. Equipment Co., Harvey, Ill.

CARS.

(Industrial.)
Chase Foundry & Mfg. Co., Columbus, O.
Whiting Fdy. Equipment Co., Harvey, Ill.
Wonham, Sanger & Bates, New York City.

CASTINGS.

(Malleable.)
Chisholm & Moore Mfg. Co., Cleveland, O.

CASTINGS.

(Phosphor-Bronze.)
Phosphor Bronze Smelting Co., Ltd., Phila., Pa.

CASTINGS.

(Steel).
National Brake & Electric Co., Milwaukee, Wis.
Otis Steel Co., Ltd., Cleveland.

CEMENT.

(Furnace.)
Gautier, J. H., & Co., Jersey City.
Harbison-Walker Refractories Co., Pittsburg.

CEMENT.

(Iron.)
Clark Cast Steel Cement Co., Shelton, Conn.
McCormick Co., J. S., Pittsburg, Pa.
Obermayer, S., Co., Cincinnati, O.
Osborn Mfg. Co., Cleveland, O.

CEMENT.

(Metallic.)
Clark Cast Steel Cement Co., Shelton, Conn.
Johns-Manville, H. W., Co., New York, N. Y.
Shanafelt Mfg. Co., Canton, O.
Shelton Metallic Filler Co., Derby, Conn.
Smooth-On Mfg. Co., Jersey City.
Whitehead Bros. Co., Providence, New York, Buffalo.

CEMENT.

(Steel.)
Clark Cast Steel Cement Co., Shelton, Conn.
Shanafelt Mfg. Co., Canton. O.

CHAPLETS.

Burdick & Son, Albany, N. Y.
Champion Machine & Forging Co., Cleveland.
Cheney & Son, S., Manlius, N. Y.
Federal Foundry Supply Co., Cleveland, O.
Osborn Mfg. Co., Cleveland, O.
Shanafelt Mfg. Co., Canton, O.

CHAPLETS.

(Perforated.)
Obermayer, S., Co., Cincinnati, O.

CHARCOAL.

Pickands-Brown Co., Chicago, Ill.
Silliman, John, Ironton, O.

CHEMISTS.

Davis, Geo. C., Philadelphia, Pa.
Gulick-Henderson & Co., Pittsburg, Pa.
Metallurgical Laboratory, Pittsburg, Pa.
Smith, Rudy & Co., Philadelphia, Pa.

CHIPPERS.

Ingersoll-Rand Co., New York, N. Y.

CHROME BRICK.

Harbison-Walker Refractories Co., Pittsburg

CINDER MILLS.

Eastern Machinery Co., The, New Haven, Ct.
Sly Mfg. Co., W. W., Cleveland, O.

CLAMPS.

(Flask.)
Barnett. Oscar, Fdy. Co., Irvington, N. J.
Diamond Clamp & Flask Co., Richmond, Ind.
Josef Mfg. Co., E. E.

COAL.

Washington Coal & Coke Co., Pittsburg, Pa.

COKE.

Baird & West, Detroit, Mich.
Debevoise-Anderson Co., New York.
Hanna & Co., M. A., Cleveland, O.
Hillman, J. H., & Son, Pittsburg, Pa.
Pickands-Brown Co., Chicago, Ill.
Rogers, Brown & Co., Cincinnati, O.
Samuel, Frank, Philadelphia, Pa.
Stevens, Frederic B., Detroit, Mich.
Washington Coal & Coke Co., Pittsburg, Pa.

COMPRESSORS.

(Air.)
National Brake & Electric Co., Milwaukee, Wis.

CONVERTERS.

(Side Blown Steel.)
Bretaud, J. V., Sandusky, O.
Stoughton Engineering Co., New York City.
Tropenas Converter Co., New York.
Whiting Fdy. Equipment Co., Harvey, Ill.

COPPER.

(Phosphorized.)
Damascus Bronze Co., Pittsburg, Pa.

CORE BINDERS.

Federal Fdy. Supply Co., Cleveland, O.
Obermayer, S., Co., Cincinnati, O.
Robeson Process Co., Au Sable Forks, N. Y.

CORE COMPOUND.

Holland Linseed Oil Co., Chicago, Ill.
McCormick Co., J. S., Pittsburg, Pa.
National Core Oil Co., Buffalo, N. Y.
Obermayer, S., Co., Cincinnati. O.
Standard Linseed Co., Cleveland, O.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Providence, New York, Buffalo.

CORE FLOUR.

Paxson Co., J. W., Philadelphia, Pa.
Piqua Flour Co., Piqua, O.

CORE MACHINES.

Brown Specialty Machinery Co., Chicago, Ill.
Detroit Core Mach. Co., Detroit, Mich.
Diamond Clamp & Flask Co., Richmond, Ind.
McCormick Co., J. S., Pittsburg, Pa.
Midland Machine Co., Detroit, Mich.
Wadsworth Core Mach. & Equip. Co., Akron, O.
Whitehead Bros. Co., Providence, New York, Buffalo.

CORE OIL.

Buckeye Products Co., Cincinnati, O.
Holland Linseed Oil Co., Chicago, Ill.
National Core Oil Co., Buffalo, N. Y.
Paxson, J. W., Co., Philadelphia, Pa.
Peterson Co., T. J., Chicago, Ill.
Standard Linseed Co., Cleveland, O.
Stevens, Frederic B., Detroit, Mich.
Thompson & Co., Allegheny, Pa.
Whitehead Bros. Co., Providence, New York, Buffalo.

CORE OIL COMPOUND.

Osborn Mfg. Co., Cleveland, O.
Paxson Co., J. W., Philadelphia, Pa.

CORE OVENS.

McCormick Co., J. S., Pittsburg, Pa.
Millett Core Oven Co., Springfield, Mass.
Monarch Engrg. & Mfg. Co., Baltimore, Md.
Obermayer, S., Co., Cincinnati. O.
Paxson Co., J. W., Philadelphia, Pa.
Rockwell Furnace Co., New York.
Smith, J. D., Foundry Supply Co., Cleveland.
Wadsworth Core Mach. & Equip. Co., Akron, O.
Whiting Fdy. Equipment Co., Harvey, Ill.

CORE.

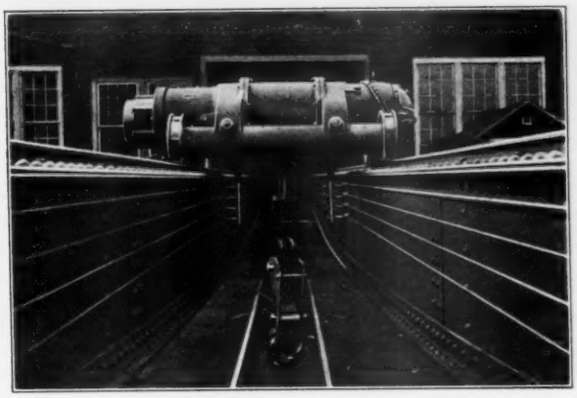
(Tapering Machines.)
Brown Specialty Machinery Co., Chicago, Ill.

Shepard

Will be at **PITTSBURG** May 23rd-June 1st, to show **Foundry Cranes** and **Hoists.** Call on us and allow us to explain the following **Shepard Features.**

ACCESSIBILITY
All parts can be taken out of trolley by simply removing six bolts.

DURABILITY
All gearing and brakes operate in oil baths, fully enclosed from dust and grit.



RELIABILITY
Wearing surfaces operating in oil as they do assures long life and few repairs.

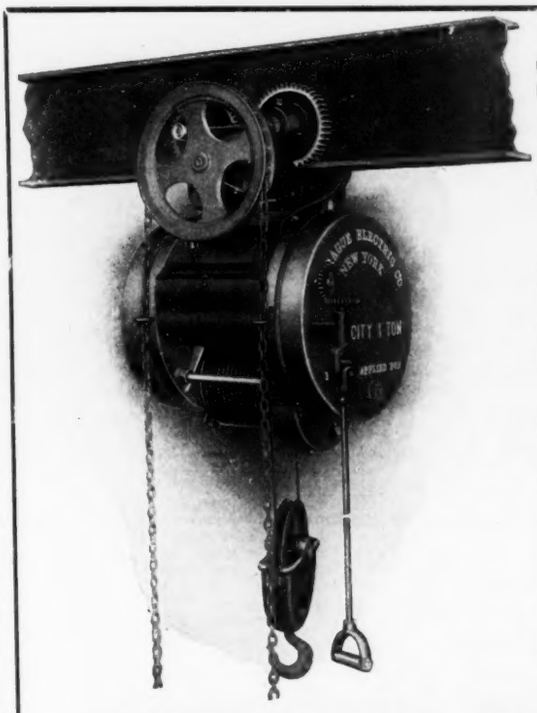
ADAPTABILITY
Cranes employing Standard Hoisting units adapted to special requirements.

CONTROL---SHEPARD FOUNDRY CRANES are equipped with controllers affording seventeen running speeds. Note enclosed features of controller on exhibit.

SHEPARD ELECTRIC CRANE & HOIST CO.

General Offices and Works : : : MONTOUR FALLS, N. Y.

New York Philadelphia Pittsburgh San Francisco Chicago Montreal



SPRAGUE ELECTRIC HOISTS

CHEAPEN AND INCREASE PRODUCTION

The Sprague Electric Hoist, made in a great variety of types and sizes, can lift and convey loads of all kinds in a quick and efficient manner. It is particularly valuable for handling those loads which are inaccessible to a large travelling crane.

For convenience, reliability and durability it is unequalled.

The S-1 Hoist shown, for loads of ½ and 1 ton, is furnished with either an A. C. or D. C. motor. It is provided with a rope guide, load brake preventing excessive lowering acceleration and an adjustable upper and lower limit switch which should prove of great value in foundry installations. The hoist is weather proof and can be used out of doors.

Illustrated Pamphlet No. 23367

SPRAGUE ELECTRIC COMPANY

527-531 West 34th Street, New York City

BRANCH OFFICES:

Chicago St. Louis Milwaukee Boston Philadelphia Pittsburg
Baltimore Atlanta San Francisco Seattle

WHERE TO BUY

CORE WASH.

Buckeye Products Co., Cincinnati, O.
Federal Fdy. Supply Co., Cleveland, O.
Stevens, Frederic B., Detroit, Mich.

CORRESPONDENCE SCHOOLS.

Milwaukee Correspondence Schools, Milwaukee.
Modern Systems Correspondence School, Boston, Mass.

COUPLINGS.

(Air Hose.)
Cleveland Pneumatic Tool Co., Cleveland, O.

CRANES.

Brown Hoisting Machine Co., Cleveland, O.
Cleveland Crane & Engrg. Co., Wickliffe, O.
Curtis & Co. Mfg. Co., St. Louis, Mo.
Maris Bros., Philadelphia, Pa.
Morgan Engineering Co., Alliance, O.
Northern Engineering Works, Detroit, Mich.
Pawling & Harnischfeger Co., Milwaukee, Wis.
Ridgway, Craig & Son, Coatesville, Pa.
Sellers, Wm., & Co., Inc., Philadelphia, Pa.
Shepard Electric Crane & Hoist Co., Montour Falls, N. Y.
Smith, J. D., Fdy. Supply Co., Cleveland, O.
Toledo Bridge & Crane Co., Toledo, O.
Whiting Fdy. Equipment Co., Harvey, Ill.

CRANES.

(Hand Traveling.)
Northern Engineering Works, Detroit, Mich.
Pawling & Harnischfeger Co., Milwaukee, Wis.
Toledo Bridge & Crane Co., Toledo, O.
Whiting Fdy. Equipment Co., Harvey, Ill.

CRUCIBLES.

Barnett, Oscar, Fdy. Co., Irvington, N. J.
Bartley Crucible Co., Jonathan, Trenton, N. J.
Dixon Crucible Co., Jos., Jersey City, N. J.
Gautier, J. H., & Co., Jersey City.
McCullough-Dalzell Crucible Co., Pittsburg, Pa.
Obermayer, S., Co., Cincinnati, O.
Paige Retort & Crucible Co., Taunton, Mass.
Ross-Tacony Crucible Co., Philadelphia, Pa.
Seidel, R. B., Inc., Philadelphia, Pa.

CRUCIBLE FURNACES.

Kroeschell Bros. Co., Chicago, Ill.
Monarch Engrg. & Mfg. Co., Baltimore, Md.

CUPOLAS.

Barry & Zecher Co., Lancaster, Pa.
Detroit Foundry Supply Co., Detroit, Mich.
Northern Engineering Works, Detroit, Mich.
Obermayer, S., Co., Cincinnati, O.
Paxson Co., J. W., Philadelphia, Pa.
Whiting Fdy. Equipment Co., Harvey, Ill.

CUPOLA BLOCK.

Harbison-Walker Refractories Co., Pittsburg.

DIPPERS.

Paige Retort & Crucible Co., Taunton, Mass.

DISCS.

(Grinding.)
Carborundum Co., Niagara Falls, N. Y.

DOWEL PINS.

Obermayer, S., Co., Cincinnati, O.
Shanafelt Mfg. Co., Canton, O.

DRILLS.

(Pneumatic.)
Ingersoll-Rand Co., New York, N. Y.

DRILLS, ELECTRIC.

(Bench, Hand and Radial.)
U. S. Electrical Tool Co., Cincinnati, O.

DUST COLLECTORS.

Cleveland Blow Pipe & Mfg. Co., Cleveland.
Knickerbocker Co., Jackson, Mich.
Sly Mfg. Co., W. W., Cleveland, O.
Sturtevant, B. F., Co., Hyde Park, Mass.

DUST EXHAUST AND COLLECTOR SYSTEMS.

Pangborn Co., Thos. W., New York City.

ELECTRIC GENERATING SETS.

Sturtevant, B. F., Co., Hyde Park, Mass.

ELEVATORS.

Curtis & Co. Mfg. Co., St. Louis, Mo.
Northern Engineering Works, Detroit, Mich.
Ridgway, Craig, & Son, Coatesville, Pa.

ELEVATORS.

(Electric.)
Northern Engineering Works, Detroit, Mich.
Whiting Fdy. Equipment Co., Harvey, Ill.

ELEVATORS.

(Pneumatic.)
Northern Engineering Works, Detroit, Mich.
Whiting Fdy. Equipment Co., Harvey, Ill.

EMERY GRINDERS.

Osborn Mfg. Co., Cleveland, O.
Smith, J. D., Fdy. Supply Co., Cleveland, O.

ENGINES.

(Steam.)
American Blower Co., Detroit, Mich.
Sturtevant, B. F., Co., Hyde Park, Mass.

ENGINEERS.

(Foundry, Mech., Elec., Etc.)
Northern Engineering Works, Detroit, Mich.
Smith, J. D., Fdy. Supply Co., Cleveland, O.
Standard Sand & Machine Co., Cleveland, O.
Wonham, Sanger & Bates, New York City.

EQUIPMENT.

(Sand Handling.)
Standard Sand & Machine Co., Cleveland, O.

EXHAUSTERS.

(Gas.)
Buffalo Forge Co., Buffalo, N. Y.
Wilbraham-Green Blower Co., Pottstown, Pa.

EXHAUST FANS.

Pangborn Co., Thos. W., New York City.
Sturtevant, B. F., Co., Hyde Park, Mass.

FACINGS.

Combined Foundry Supply Co., Buffalo, N. Y.
Detroit Foundry Supply Co., Detroit, Mich.
Dixon Crucible Co., Jos., Jersey City.
Federal Fdy. Supply Co., Cleveland, O.
Kelly, T. P., & Co., New York, Chicago, Hamilton.
Obermayer, S., Co., Cincinnati, O.
Paxson Co., J. W., Philadelphia, Pa.
Pettinos Bros., Bethlehem, Pa.
Stevens, Frederic B., Detroit, Mich.

FANS.

American Blower Co., Detroit, Mich.
Buffalo Forge Co., Buffalo, N. Y.
Sturtevant, B. F., Co., Hyde Park, Mass.

FASTENERS.

(Corrugated Steel.)
Shanafelt Mfg. Co., Canton, O.

FERRO-ALLOYS.

Blackwell, Geo., Sons & Co., Ltd., Liverpool, Eng.
Primos Chemical Co., Primos, Pa.

FERRO-COMPOUND.

Johns-Manville, H. W., Co., New York, N. Y.

FERRO-MANGANESE.

Pickands-Brown Co., Chicago, Ill.
Rogers, Brown & Co., Cincinnati, O.
Stevens, Frederic B., Detroit, Mich.

FERRO-SILICON.

Pickands-Brown Co., Chicago, Ill.
Roessler & Hasslacher Chemical Co., New York.
Rogers-Brown & Co., Cincinnati-Pittsburg.

FERRO-VANADIUM.

Primos Chemical Co., Primos, Pa.

FILLERS.

(Metallic.)
Clark Cast Steel Cement Co., Shelton, Conn.
Shanafelt Mfg. Co., Canton, O.
Shelton Metallic Filler Co., Derby, Conn.
Smooth-On Mfg. Co., Jersey City, N. J.

FILLETS.

(Leather and Wood.)
Obermayer, S., Co., Cincinnati, O.
Shanafelt Mfg. Co., Canton, O.
Wellman Pattern Supply Co., Cleveland, O.

FIRE BRICK.

Combined Fdy. Supply Co., Buffalo, N. Y.
Detroit Foundry Supply Co., Detroit, Mich.
Gautier, J. H., & Co., Jersey City.
Harbison-Walker Refractories Co., Pittsburg.
Maurer, Henry, & Son, New York City.
Obermayer, S., Co., Cincinnati, O.
Paxson Co., J. W., Philadelphia, Pa.
Valentine, M. D., & Bro., Co., Woodbridge, N. J.
Wonham, Sanger & Bates, New York City.

FIRE CLAY.

Gautier & Co., J. H., Jersey City, N. J.
Harbison-Walker Refractories Co., Pittsburg.
Paxson Co., J. W., Philadelphia, Pa.
Whitehead Bros. Co., Providence, New York, Buffalo.

FIRE SAND.

Ellwood Sand Co., Pittsburg, Pa.
Detroit Foundry Supply Co., Detroit, Mich.
Paxson Co., J. W., Philadelphia, Pa.
Whitehead Bros. Co., Providence, New York, Buffalo.

FLASKS.

Adams Co., Dubuque, Iowa.
Barnett, Oscar, Fdy. Co., Irvington, N. J.
Brass Founders' Supply Wks. Co., Newark, N. J.
Buckeye Products Co., Cincinnati, O.
Killing's Molding Mch. Wks., E., Davenport, Ia.
McCormick Co., J. S., Pittsburg, Pa.
Osborn Mfg. Co., Cleveland, O.
Shanafelt Mfg. Co., Canton, O.
Sterling Wheelbarrow Co., West Allis, Wis.
Stevens, Frederic B., Detroit, Mich.

FLASKS.

(Hingeless.)
Graf Molding Device Co., Louisville, Ky.

FLASKS.

(Iron.)
Barnett Fdy. Co., Oscar, Irvington, N. J.
Graf Molding Device Co., Louisville, Ky.
Morner & Smith, Dayton, O.
Turner Machine Co., Philadelphia, Pa.

FLASKS.

(Snap.)
Adams Co., Dubuque, Iowa.
Brass Founders' Supply Co., Newark, N. J.
Diamond Clamp & Flask Co., Richmond, Ind.
Graf Molding Device Co., Louisville, Ky.
Killing's Molding Mch. Wks., E., Davenport, Ia.
Morner & Smith, Dayton, O.
Obermayer, S., Co., Cincinnati, O.
Paxson Co., J. W., Philadelphia, Pa.
Shanafelt Mfg. Co., Canton, O.
Smith, J. D., Fdy. Supply Co., Cleveland, O.

FLOUR.

(Core.)
Federal Fdy. Supply Co., Cleveland, O.
Piqua Flour Co., Piqua, O.

FLUOR-SPAR.

Rogers, Brown & Co., Cincinnati, O.
Stevens, Frederic B., Detroit, Mich.

FLUX.

Uraniumite Co., Buffalo, N. Y.

FORGINGS.

Champion Machine & Forging Co., Cleveland.

FOUNDRY EQUIPMENT.

(Iron and Brass.)
Barnett, Oscar, Fdy. Co., Irvington, N. J.
McCormick Co., J. S., Pittsburg, Pa.
Monarch Engrg. & Mfg. Co., Baltimore, Md.
Northern Engineering Works, Detroit, Mich.
Obermayer, S., Co., Cincinnati, O.
Paxson Co., J. W., Philadelphia, Pa.
Sly, W. W., Mfg. Co., Cleveland, O.
Standard Sand & Mach. Co., Cleveland, O.
Stevens, Frederic B., Detroit, Mich.
Whiting Fdy. Equipment Co., Harvey, Ill.
Wonham, Sanger & Bates, New York City.

FOUNDRY SUPPLIES.

Birkenstein & Sons, Chicago, Ill. (Brass.)
Buckeye Products Co., Cincinnati, O.
Combined Fdy. Supply Co., Buffalo, N. Y.
Detroit Foundry Supply Co., Detroit, Mich.
Federal Fdy. Supply Co., Cleveland, O.
Hanna Engineering Works, Chicago, Ill.
Kelly, T. P., & Co., New York, Chicago, Hamilton.
Obermayer, S., Co., Cincinnati, O.
Osborn Mfg. Co., Cleveland, O.
Paxson Co., J. W., Philadelphia, Pa.
Shanafelt Mfg. Co., Canton, O.
Smith, J. D., Fdy. Supply Co., Cleveland, O.
Standard Sand & Machine Co., Cleveland, O.
Stevens, Frederic B., Detroit, Mich.
Whitehead Bros. Co., Providence, New York, Buffalo.

FUEL BURNING APPLIANCES.

(Oil.)
Hauck Mfg. Co., Brooklyn, N. Y.

FURNACES.

Best, W. N., New York.
Hawley Down-Draft Furnace Co., Chicago, Ill.
Monarch Engrg. & Mfg. Co., Baltimore, Md.
Rockwell, W. S., Co., New York, N. Y.
Smith, J. D., Fdy. Supply Co., Cleveland, O.

FURNACES.

(Annealing.)
Monarch Engrg. & Mfg. Co., Baltimore, Md.

FURNACES.

(Brass.)
Hawley Down-Draft Furnace Co., Chicago, Ill.
Kroeschell Bros. Co., Chicago, Ill.
Monarch Engrg. & Mfg. Co., Baltimore, Md.
Paxson Co., J. W., Philadelphia, Pa.
Rockwell Furnace Co., New York.
Whiting Fdy. Equipment Co., Harvey, Ill.
Wise, J. B., Watertown, N. Y.

FURNACES.

(Case Hardening.)
Monarch Engrg. & Mfg. Co., Baltimore, Md.

FURNACES.

(Crucible Steel.)
Hawley Down-Draft Furnace Co., Chicago, Ill.
Whiting Fdy. Equipment Co., Harvey, Ill.

FURNACES.

(Galvanizing.)
Monarch Engrg. & Mfg. Co., Baltimore, Md.

FURNACES.

(Heating.)
Monarch Engrg. & Mfg. Co., Baltimore, Md.